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ROCKY MOUNTAIN FRONT GRIZZLY BEAR MANAGEMENT PROGRAM

Four-Year Progress Report 1991 - 1994

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Montana Fish, Wildlife & Parks

MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS

FOUR-YEAR PROGRESS REPORT

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Rocky Mountain Front Grizzly Bear Management Program

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INTRODUCTION

In the early 1980's, conflicts between grizzly bears (*Ursus arctos h.)* and people increased around the fringe areas of the Northern Continental Divide Ecosystem (NCDE) in northwestern Montana. The Rocky Mountain Front (RMF) east of the Continental Divide experienced a significant rise in grizzly bear interactions with private landowners and property. Much of the critical low elevation grizzly habitat on the RMF is comprised of privately owned land, where up to 70 percent of all nuisance bear incidents have been reported.

Grizzly bears seasonally migrate to low elevation areas to forage, where they often come into close proximity to people and various types of unnatural and concentrated food attractants. As a result, bears become habituated and are observed more frequently; conflicts arise when property damage occurs, or people are concerned for their safety. Negative attitudes towards grizzlies develop with local residents, and illegal bear mortalities increase as people are less willing to tolerate bears on private lands. In backcountry and wilderness areas without adequate preventative methods and sanitation guidelines in place, bears access and are rewarded with human foods causing an increase in encounters and camp damage conflicts.

Similar patterns in bear-human conflicts have been reported throughout much of the northern hemisphere where brown bears exist (Servheen 1990). On Hokkaido, the northern island of Japan where brown bears and people occur in high densities, I observed analogous bear-human conflict situations on private lands peripheral to bear population centers compounded with the effects of habitat loss and fragmentation (Mano 1987). Information is limited on methods and strategies for effective bear-human conflict management, including interrelated population and habitat factors for application on private and nonfederal land areas, critical to long term bear conservation efforts.

In response to bear management concerns, the bear's Endangered Species "threatened" status, and mandated state wildlife management responsibilities, the Montana Department of Fish, Wildlife and Parks (MFWP) developed and implemented the Rocky Mountain Front Grizzly Bear Management Program. The primary goal is to secure and maintain a recovered grizzly bear subpopulation while minimizing conflicts between bears and people. Program objectives support several stepdown recovery goals for the NCDE as outlined in the Grizzly Bear Recovery Plan (USFWS 1993), and meet or exceed recommendations in the Grizzly Bear Programmatic Environmental Impact Statement (Dood et al. 1986, Dood and Ihsle Pac 1993).

This progress report summarizes program results for the four-year period 1991 to 1994. I describe and evaluate management projects and specific techniques in relation to bear-human conflicts, and population and habitat parameters.

The conservation and management of grizzly bears on the RMF has been built upon by many dedicated professionals since the conception of this program in 1986. Regional Supervisors Dan Vincent and Mike Aderhold have consistently provided strong support and expert input for this

program through the years. A special thanks goes to Jim Carlson, research technician for this project for eight years, who has provided a "local" understanding, and whom I spent many a long hour with responding to bear conflicts.

Great appreciation goes out to wildlife biologist Kerry Constan who helped in every way possible to see this program through, and put up with crazy new ideas for managing bears. I appreciate the expertise and support provided by regional wildlife manager Graham Taylor, endangered species biologist Arnold Dood, and Keith Aune, wildlife lab supervisor. Thanks for the many hours of assistance with bear-people conflicts provided by game wardens Larry Davis, Tom Bivins, Tom Flowers, and Bryce Christensen; and area wildlife biologists Gary Olson, John McCarthy, Tim Manley, and Quinton Kujala who also assisted greatly in computer programming and dBase training. Vince Yannone and Steve McMorran, the department's premiere wildlife rehabilitators, were instrumental in initiating the reintroduction of orphaned black bear cubs to the wild, and it has been a privilege working with them.

For interagency and organization cooperation and support I thank Dan Carney with the Blackfeet Fish and Wildlife, Dave Carr, Mary Sexton, Joe Moll and Dave Hanna with the Nature Conservancy, Hank Fisher with Defenders of Wildlife, Lance Olson and Chuck Jonkel with the Great Bear Foundation; Don Godtel, Seth Diamond, Pat Finnegan and other personnel with the Lewis and Clark National Forest; and the many RMF landowners and residents who I have come to know as friends and work with, thank you.

I especially thank Vickie Madel and my children Ben, Vanessa, Gabe, and Daniel, whom have always been a tremendous support through the years, seeing me through the most hectic of seasons, even when a family event was missed responding to "another" grizzly bear conflict.

OBJECTIVES

1. To develop and implement a regional bear management program designed to reduce conflicts between grizzly bears and people along Rocky Mountain Front (RMF), while managing for a subpopulation level towards grizzly bear recovery in the Northern Continental Divide Ecosystem (NCDE).

2. Obtain necessary data, develop methods, and manage for effective high quality grizzly bear habitat.

3. To promote bear-human conflict prevention by disseminating information to the public; thus encouraging cooperative proactive planning rather than reactive management actions.

STUDY AREA

Located in northwestern Montana, the Rocky Mountain Front forms the east flank of the NCDE south of Glacier National Park and east of the Continental Divide, containing 4750 square kilometers (1834 mi^2) of occupied grizzly bear habitat (Figure 1). Along the Front, rolling prairie grasslands abruptly meet the rocky reefs and timbered ridges of the Sawtooth Mountain Range. The foothills exist as a relatively narrow transition zone from which riparian vegetation extends into the plains and provides food and cover for grizzly bears far from mountainous habitat. Large tracts of isolated private ranchlands are adjacent to the rugged Lewis and Clark National Forest boundary.

The RMF is one of the last remnant areas in the world where brown bears commonly inhabit open plains, as first documented by early explorers M. Lewis and W. Clark in 1805 (Thwaites 1904). The study area is described indepth by Schallenberger and Jonkel (1980). Aune and Kasworm (1989) provide recent grizzly bear density estimates, population characteristics, and ecological information for the RMF.

METHODS

The Rocky Mountain Front Grizzly Bear Management Program was developed from research information collected over ten years of intensive field studies and from related guiding agency documents (Dood et al. 1986, IGBC 1987, USFWS 1981, Aune and Kasworm 1989). Data was collated with regional social factors, including land ownership, human occupancy patterns, and land uses to delineate bear management zones and allocate management activities.

Four program management strategies further defined project objectives and were used to prioritize and prescribe specific field work activities. Program strategies include: 1. bear-human conflict management, 2. population management, 3. habitat management, 4. program evaluation (Appendix A). Information and educational efforts, preventative techniques, control actions, and zone allocation were general methods used to minimize the rate of and potential for human-bear conflicts. Upon completion of the draft management plan in 1987, a 14 month period of public involvement and comment was conducted on a local and statewide basis by procedures of "citizen participation" as described by Bleiker (1986). Revisions were made based on received comments, and the RMF Grizzly Bear Management Program was implemented in April, 1988. Program results and trend comparisons regarding grizzly bear-human conflict management and population monitoring during the previous five year period, 1986 to 1990, are described by Madel (1991).

Ongoing public relations consisted of informing and cooperatively working with landowners and local communities on ways to coexist with bears. Information on grizzly bear ecology, management, and conflict avoidance was disseminated by individual contacts with local residents and through scheduled group presentations.

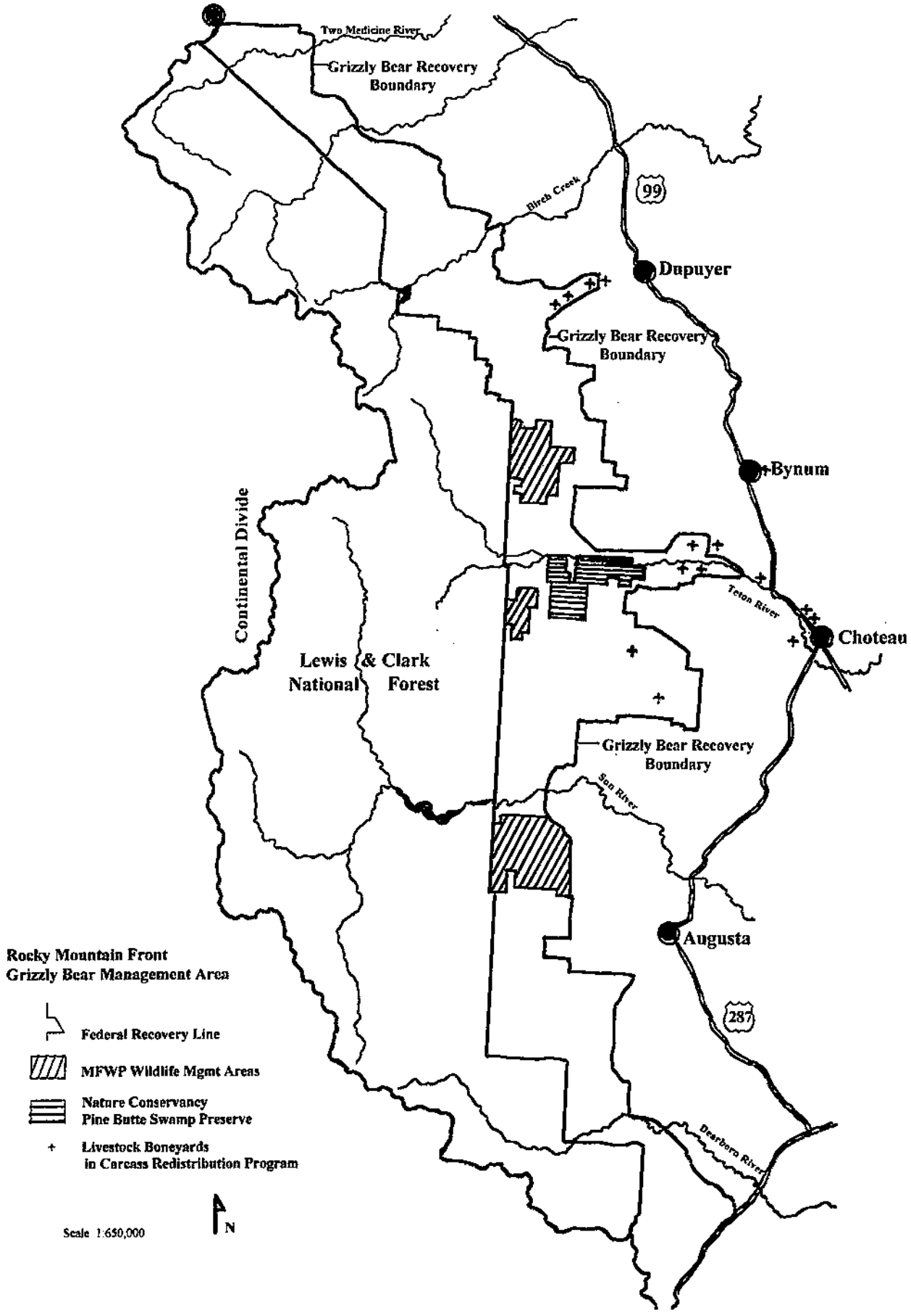


Figure 1. Rocky Mountain Front Bear Management Area in northwestern Montana.

Preventive management techniques were applied in the field to either remove or control unnatural food sources, modify undesirable bear behavior, or limit public access in certain conflict areas. RMF residents were encouraged to use bear resistant garbage containers when feasible, or to store refuse cans inside a closed building. Larger scale community or area refuse sites were modified or moved through cooperative efforts with county and regional sanitation departments.

Domestic livestock carcass disposal sites located on private ranch lands ("boneyards") that were known to attract grizzly bears long distances and act as a source for bear-people conflicts, were phased out through implementation of a boneyard reduction/carcass redistribution plan. The objectives of the project were to remove a concentrated natural food attractant from the vicinity of ranch operations while not removing an important spring protein source for grizzlies from the RMF. Livestock carrion was redistributed to secluded core areas along the Front where bears search for wild ungulate carrion early in the spring.

During April and May each year, livestock carcasses were collected from high conflict boneyards located west of the communites of Choteau, Bynum, and Dupuyer (Figure 1). Carcasses were transported on a 1-ton flatbed truck with a rear mounted electric-hydraulic crane used to load large animals. These were then redistributed into 1 of 4 geographically separate ungulate winter range areas located along the Front foothills. Three were MFWP state Wildlife Management Areas (WMA), that occupy a combined 143 km^2 closed seasonally to public access between Dec. 1- May 15. In cooperation with The Nature Conservancy, the 73 km^2 Pine Butte Swamp Preserve west of Choteau functioned as a primary redistribution area.

A random numbers dot grid overlaying 1:24,000 scale topographical maps was used to randomly distribute carcasses each year within the four areas (Marcum and Loftsgaarden 1980). Livestock carrion was placed at an average density of approximately one carcass equivalent per 2.0 km^2 (where one carcass equivalent equals one adult cow or ten calves, or equal weight in sheep). Specific guidelines were developed in cooperation with landowners adjacent to redistribution areas to standardize carcass placement methods and minimize potential hazards (Madel 1991). Carcass redistribution sites were visited biweekly in 1991, and less often between 1992-1994, to collect information on carrion use, consumer species, and consumption rates.

Permanent electric fence systems were erected around sites containing concentrated food attractants previously used or damaged by bears that could not otherwise be managed or removed. Attractants included apiaries, domestic sheep bedding grounds, a pig-rearing facility, and a livestock carcass disposal site, all located on private lands. Fence construction and costs were shared through cooperative arrangements between a beekeeper or livestock operator, and the MFWP. Two conservation organizations, the Great Bear Foundation and Defenders of Wildlife, provided funding on a cost-share basis for three fence systems.

We designed two electric fence systems based on the type of attractant to be enclosed. Fences were constructed with five to nine strands of 2.5 mm high-tensile galvanized steel wire, plastic post

insulators, porcelain end insulators, and fence energizers manufactured by Gallagher Power Fence, Inc. Standard 9 cm diameter by 2.1 m long treated wood in-line posts spaced 5 m apart, and 11 cm diameter corner posts wired into strong wood corner and end braces wood were used to construct permanent fence systems. Various gate designs were constructed depending on access needs.

Remote fences were powered by a DC energizer connected to a deep-cycle 12-volt battery that emitted 60 pulses a minute, with a peak output of 7000 to 8000 volts. Ten watt solar panels were connected to batteries to maintain adequate charge for 5 to 6 months of field operation. Two sheep bedding ground fences were powered from alternate current sources and emitted 40 pulses/min with a peak output of 7,600 volts. Fence systems were grounded to at least two 2 m galvanized steel rods driven 10 m apart in the moistest soil available. Minor modifications were made over time with some fences to simplify maintenance.

Permanent fences around apiaries encompassed about .1 ha and were built using 9 strands of alternating positive (+ hot) and negative (- grounded) wires. Early fence designs constructed in 1986 consisted of all positive wires with a steel mesh (-) staked flat to the ground around the outside perimeter of the fence, but were later changed to alternating hot/ground wire systems due to the difficulty of maintaining ground mesh. A similar fence design was used to deter grizzly bears from accessing a cattle feedlot carcass disposal site, but encompassing a larger area.

For livestock bedding grounds, a second fence design was constructed using .9 m high square page wire (-) as a lower barrier with 5 electric extension wires (+) to the outside and above the mesh (Figure 5). The lower page wire acted as a barrier to prevent sheep or pigs from running through the fence to the outside when disturbed by approaching predators, while protecting animals inside the electric field.

Information was collected on livestock-guarding dogs and the effectiveness dog breeds have had in protecting sheep from bears. Accounts of guard dog-bear encounters on the RMF and the success dog owners had in reducing predator kills were gathered. Literature on raising and training, different breeds, and estimated costs of livestock guard dogs was distributed to most sheep operators living in grizzly habitat.

Propane operated scareguns (manufactured by Zon, Inc.) were set and maintained at certain problem bear situations to function as acoustic deterrents. Scareguns were typically used near concentrated attractant sites, residential areas, or sheep bedding grounds to reduce the potential for reoccurring depredations or damage. Guns were set to detonate every 10 to 15 minutes during the hours of darkness.

Manually activated repellents were used on a restricted basis to deliver unpleasant or painful stimuli to bears and modify negative behaviors or repel bears away from humans and residences. Plastic slug projectiles and fire cracker shells fired from twelve gauge shotguns were used to physically or acoustically repel bears without causing penetration or injury to an animal (Clarkson 1989).

Bear conflict investigative report forms were developed to collect detailed site information for reliable field appraisals. Data recorded at conflict locations assisted in determining species of bear, or other causes/predators involved; known sex and age of the animal, behavior patterns exhibited, and circumstances that contributed to a conflict. Records were entered into a dBase III software program to facilitate analysis.

Control actions methods involved capturing nuisance bears with steel cable snares, aluminum culvert traps, or free-range darting by helicopter aircraft. A syringe rifle was used to deliver drug to snared or free-ranging bears, while culvert contained animals were injected using modified air pistol. A 1:1 mixture of tiletamine hydrochloride and zolazepam hydrochloride (Telazol) was used to immobilize grizzly bears, and a 2:1 ratio of ketamine hydrochloride (Ketaset) and xylazine for most black bears. Bears were permanently marked with a numbered lip tatoo, given numbered ear tags, and physical measurements and a spring scale whole weight were taken. Grizzly bears were fitted with radio transmitters in the 165 MHz range.

Relocation or removal of individual bears from conflict sites was determined through established interagency guidelines and consultation (IGBC 1986). Bears were transported to predetermined sites in closed, air-cooled aluminum culvert traps secured to a flatbed truck, and released using an electric-hydraulic hoist operated from inside the vehicle cab to raise the trap door. Radio instrumented bears were monitored during aerial telemetry flights from a Piper Supercub and from specific ground locations. Radio locations were plotted on USGS 1:24000 quad maps and recorded as UTM coordinates.

As part of the NCDE population monitoring strategy observations of adult female grizzly bears with litters were collected annually from direct sightings, individual captures, and other field sign (Dood et al. 1986, USFWS 1993). Only observations with high reliability ratings were included in the analysis. Litter size was determined from records of marked bears and unduplicated sightings of females with cubs or subadult young. Sightings and telemetry data were used to identify grizzly bear distribution in the RMF area and occupancy of adult females.

Mortality data and hunter harvest information was obtained from hunter questionnaire surveys and agency summary reports (Ishle-Pac and Dood 1994). A five week, early spring grizzly bear hunting season was implemented in the RMF Bear Management Area in 1991 as described in MFWP Season Recommendation (Appendix C).

In evaluating management program results for the progress report period it is recognized that significant statistical analyses were not possible due to limited sample sizes. Results are presented in summary and percentage form for basic comparisons, yet reliable confidence intervals are not implied.

RESULTS AND DISCUSSION

Bear-Human Conflict Management

Region Four RMF grizzly bear program objectives and management strategies were expanded and modified during the four year progress report period based on recent management and research results (Madel 1991). Conflict prevention methods, including the use of electric fence systems, livestock carcass redistribution, and information and education were increased through zone management allocation. The number of control actions taken per conflict were reduced during the same period, and the distance that nuisance grizzly bears were relocated was less. 1994 was the seventh consecutive year the grizzly bear management program was implemented in the RMF Bear Management Area (BMA). The 1991-1994 progress results are summarized under each program strategy.

Information and Education

Involved in day-to-day activities was that of informing people and providing RMF residents with a better understanding regarding grizzly bears, their habitat requirements, and how to effectively prevent conflicts. Meeting with landowners individually resulted in opportunities to discuss bear management issues and answer questions typically not asked in a group setting. Approximately 862 landowner contacts, or an average of 216 annually, were made during the progress report period. Contacts with ranchers and agricultural operators were conducted primarily during the field season months from March to November. Contacts were made regularly with sportsmen and women to provide them with hunting/fishing season regulations, ecological information, and explain methods for differentiating between black and grizzly bears afield (Table 1).

Scheduled group presentations to local communities, schools, and special interest groups provided an avenue in which to introduce additional information on grizzly and black bear ecology, management, and conflict avoidance, while also encouraging discussion on specific concerns. Fifty presentations were given to groups ranging from interested adult listeners to grade school students anxious to learn more about bears.

We worked closely with other agency personnel to develop Project Wild Teachers Training programs titled "Wild About Bears". These involved educators from around the state and nation that had personal interests in learning and collating information on bears in Montana. Key management issues between people and bears were presented by local ranchers and other residents. Education manuals were put together for instructors to transfer bear information and materials to the classroom. Project Wild training seminars were conducted each spring in grizzly bear environments on the RMF through the MFWP's Conservation Education Division. Over 120 teacher-coordinators attended the seminars during the four years.

Many information requests regarding bear management topics were received annually from

Table 1. Grizzly bear management information and education methods conducted during the report period, MFWP Region Four.

I & E Method	1991	1992	1993	1994	4-Year Sum	4-Year Average
Landowner/Local Resident Contacts	209	234	221	198	862	216/yr
Sportsmen Contacts	64	29	35	51	179	45/yr
Information/Education Presentations	16	10	25	11	62	16/yr
Newspaper/Television Interviews	32	19	9	6	66	17/yr
Bear Management Information Requests	43	53	68	34	198	50/yr
Interagency Coordination & Assistance	46	55	70	74	245	61/yr

individuals and groups (average 50 requests a year). Requests were responded to by providing or sending additional documentation related to specific questions, such as the use of electric fences in deterring bear damage or other preventative measures. At a local and regional level it is estimated that 2854 people were directly reached regarding grizzly and black bear ecology and conflict management.

At a broader geographical scale, the concept and goals of the RMF grizzly bear management program were presented to agencies and groups in Great Falls, Billings, Missoula, Kalispell, Seattle WA., and in Chicago IL. Many newspaper, television documentary, and other media interviews were conducted (67 interviews total) that resulted in several newspaper and magazine articles as well as televised educational programs by National Geographic, ESPN TV, and local broadcast stations reaching a much wider listening audience.

The effectiveness of bear information and education programs within a local region is difficult to express in measurable terms. In general, social attitudes of landowners and people living in the RMF area toward grizzly bears have improved steadily since 1988, resulting in a certain willingness to accept a grizzly bear population cohabiting an area of mixed land ownership. It appears from frequent contact with landowners, that although there are a few that certainly dislike bears, the majority take an active interest in grizzlies and express greater tolerance, and at times even support for bears occupying their lands.

Few human attitude survey studies have been conducted outside national parks or reserves. Perry (1977) and Frost (1985) found that over 60% of the residents in two western Montana valleys supported having grizzly bears in their area. Residents with favorable attitudes toward grizzlies also tended to have more knowledge about bears in the wild. Regional or "local" programs offer the flexibility to target and cooperatively work with residents who have opposing views toward bears. In correcting human misunderstanding about bears with factual information, often people with negative attitudes have come to accept grizzly bear recovery under managed conditions.

Preventative Management

Preventative management techniques applied in the field reduced the number of grizzly bear conflicts each year. Prevention integrated with information and education assisted in minimizing the potential for bear-people conflicts. The investigation of conflict incidents provided opportunities to discuss bear management issues with complainants. One of the primary comments received from residents during the development of the RMF bear program was the need for agency personnel to respond to grizzly nuisance reports in a timely manner, and quickly resolve conflicts. Of 136 bear-human conflict reports received between 1991 and 1994, we conducted 121 field investigations, at times in cooperation with other agencies, including USDA Animal Damage Control, US Forest Service, and US Fish & Wildlife Service. Nuisance bear investigation reports were completed for all complaints investigated by the MFWP, with specific data pertinent to the type of conflict incident collected at each site.

We found that most bear-human conflicts were related to some source of attractant, whether anthropomorphic or natural in origin. Certain odors, even when food attractants were not available, tended to lure grizzly bears long distances into close proximity to people and property. Using a simple attractant assessment category, we calculated that 82% (n=84) of all bear-caused conflicts were attractant-related.

The most common attractant on the RMF were livestock concentrations (30%). Grizzly bears often approached traditional sheep bedding grounds or calving areas that were heavily saturated with animal odors, at times including afterbirth remains and occasionally dead livestock. Human foods and garbage in backcountry camps or at residences accounted for 25% of attractant related incidents, while 9% involved livestock feeds, and 9% specific refuse sites. Livestock carcasses accounted for 8% of the incidents, beehives 8%, domestic crops, gardens and lawns less than 5 percent.

As a result of investigation efforts, attractants (other than livestock carcass redistribution efforts) were removed or made unavailable at 45% of the conflict sites (n=55). Proactive prevention methods used to effectively manage attractants and promote conflict avoidance are summarized by topic in the following sections.

Unnatural Food Attractants

Community refuse dumps and garbage dumpsters located in the RMF BMA, including Dupuyer, Choteau, Augusta, and Teton River area were removed or modified between 1991 and 1994. With

a change in sanitation policy and management, community refuse pits known to be occasionally used by grizzly bears were closed permanently and replaced with large semitruck size contained steel depot bins with steel mesh lids. In periodically checking these refuse depot sites there was no evidence that bears accessed food or spent time in the area.

Efforts continued towards working with private landowners and homeowners on ways to handle known and potential attractants in occupied grizzly habitat. MFWP and interagency bear information brochures were regularly provided to people living in bear habitat. Inevitably, bears themselves tended to expose available attractants that were obscure until such became the cause of conflict. As subdivision areas located close to the front or in mountainous drainages increase in size along with rural home construction, cooperative programs to deal more effectively with garbage, birdfeeders, and other types of attractants will need to be implemented. County zoning plans could assist in preventing bear-homeowner conflicts similar to progressive planning and ordinances implemented in Missoula and Flathead Counties (Manley 1995).

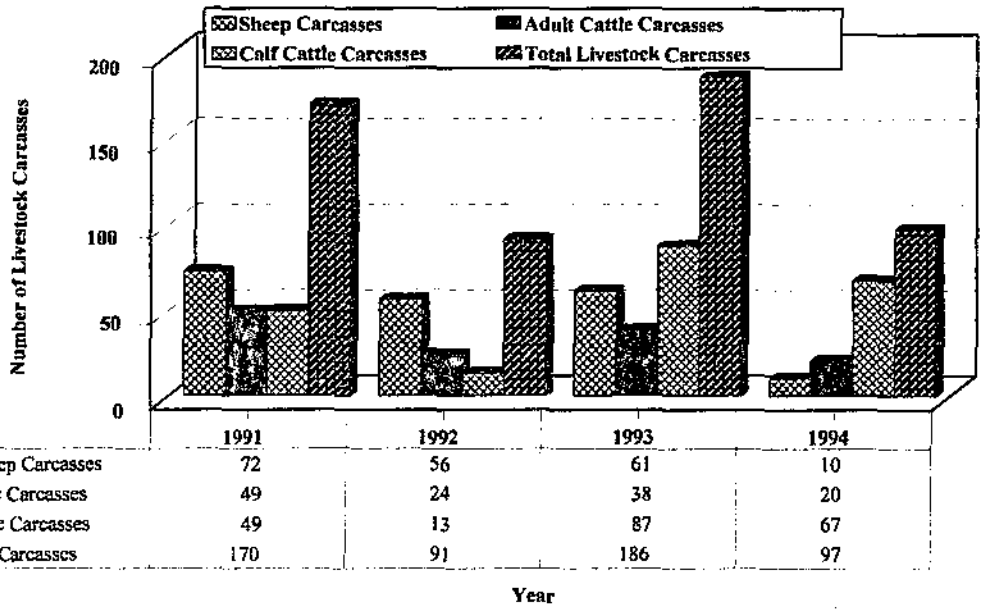
There was a significant increase in the number of attractant-related grizzly-human conflicts on Lewis and Clark National Forest (LCNF) public lands. In 1992 there was an eight fold increase in human foods-related conflict, most of which could be attributed to four grizzly bears (an adult female with two subadult young, and 1 or 2 individual bears). Preventative measures were implemented during the summer of 1992 as defined in the LCNF Nuisance Bear Policy (LCNF 1991), including three trail closures, several backcountry camp closures (n=7), and increased public awareness Although these efforts provided temporary relief from conflicts in certain areas, bears tended to move to other backcountry drainages searching for human foods.

As a result of escalating conflicts due to serious food conditioned behavior, three female grizzly bears were removed from the ecosystem. In 1994, the LCNF implemented a District wide special food order to better regulate and limit the availability of human and livestock foods in backcountry camps (USFS 1994).

Livestock Carrion

The livestock carcass redistribution project was implemented for a seventh consecutive year in 1994. It was expanded beyond the initial Teton River study area based on earlier project results (Madel 1991) to include the lower reaches of Dupuyer Creek, Spring Creek, and Deep Creek (Figure 1). High-conflict boneyards located in management zones B and D were phased out in April and May each year. The number of boneyards phased out annually varied from 9 to 14, dependent upon carrion availability as it related to livestock death losses. High conflict boneyards accounted for the redistribution of 555 livestock carcasses (139 carcasses/yr) during the 4 year period. Of this total, 40% were calf carcasses (n=216), 25% adult cattle (n=140), and 35% sheep (n=199).

The number of livestock carcasses available to bears from one year to the next fluctuated by as much as 100%, depending on the severity of weather conditions, disease, and other factors during the calving and lambing seasons (Figure 2). Although the annual number of boneyards phased out



	1991	1992	1993	1994
Sheep Carcasses	72	56	61	10
Adult Cattle Carcasses	49	24	38	20
Calf Cattle Carcasses	49	13	87	67
Total Livestock Carcasses	170	91	186	97

Figure 2. Livestock carcasses redistributed annually between 1991 and 1994 on the Rocky Mountain Front.

nearly doubled since 1990, the amount of carrion redistributed decreased by 18 percent. The amount of livestock carrion in the project area may not be representative of all private RMF ranch lands, but does provide an example of the abundant source of protein available to grizzles in the spring.

Ground surveys of carcass redistribution sites on the WMA's and Pine Butte Swamp Preserve were limited to occasional visits. Refer to Madel (1991) for more indepth analysis of grizzly bear use of carrion and consumption rates. Based on field observations combined with remote camera photography at specific sites, it was appeared that grizzly bear use of the carcass redistribution areas increased between 1991 and 1994, particularly on the Blackleaf WMA and TNC Preserve. The timing and amount that bears used carcasses varied between years and appeared to be a function of den emergence dates and prevailing spring weather conditions. Grizzlies located and fed on carcasses at a greater rate as the season progressed.

From the decrease of 84% in spring grizzly bear conflicts reported earlier for the Teton River Basin (Madel 1991), The number of grizzly bear conflict incidents in the Teton River Basin remained stable to slightly decreasing during the report period, compared to an 84% decrease in conflicts reported for the same area between 1988 and 1990. In relation to the expanded boneyard reduction project area, total RMF spring grizzly bear-human conflicts decreased 78% from the preprogress report period; from an average of 9 conflicts/year between 1986-1990 to an average of 2 conflicts/year between 1991 and 1994.

Annual cost estimates for the livestock carcass redistribution project conducted at the expanded level include; $ 610.00 for mileage (average 782 mi/year), $ 200.00 in materials, and total of 8 to 10 mandays. In comparison, a single management control action involving the capture of one grizzly bear on the RMF and subsequent relocation to the west side of the NCDE averages 648 miles, involving a minimum of 6 mandays.

Livestock death losses are common in the late winter and spring on ranch lands along the RMF, and have been over the past century since the front was first settled. It is likely that livestock carrion to some degree took the place of dwindling winter-kill wild ungulate carrion such as bison and elk, available to grizzly bears and other carnivores across the high plains before the homestead era. Livestock carrion is an important traditional protein source for RMF bears, especially in the spring.

Grizzlies make nocturnal movements across prairie and riparian habitats to feed at boneyards, often remaining in the area several days. Aune and Kasworm (1989) documented that grizzly movements east toward local communities were directly linked to the availability of boneyards, encouraging bears to remain in these areas. Due to the concentration of carrion and the linear positioning of boneyards along river bottoms, grizzly bears are attracted into the proximity of ranch buildings and human activity. Individual bears become habituated over time to these types of stimuli, thus lessening a response to flee when disturbed and increasing the potential for conflict (Matson 1990). On the Blackfeet Indian Nation lands located north of the RMF BMA, it was found that 80% of all nuisance grizzly bear complaints that resulted in trapping efforts involved bears that were attracted to livestock carcasses, typically at traditional boneyards (Carney 1990).

The removal of livestock carcasses from potentially high conflict areas and redistributing carrion to remote seasonal habitats has contributed significantly to reducing grizzly-human conflicts along the RMF. Our results have shown that there is no correlation between grizzlies feeding on livestock carcasses and the same bears being prone to prey on livestock. It is likely that bear conflicts will increase over time if the livestock redistribution program is abandoned, or if carcasses are removed from front lands traditionally used by bears to search for carrion.

Deterrents and Repellents

Electric Fence Systems

Permanent electric fence systems built before 1991 were 100% effective as deterrents against access and damage by bears during the report period. Existing electric fences were monitored and maintained in cooperation with the owners. Four remote beeyard fences were improved by adding solar panels to each system due to problems in maintaining adequate charge of 12 volt batteries. Grizzly bears caused damage to unprotected apiaries in nine incidents outside the recovery line at sites within 1 km of electric fenced apiaries not damaged.

At a large 16 ha electric-fenced sheep bedding ground and one feedlot carcass disposal site, the

number of documented grizzly bear attempts to access sites, including observations and sign of bears in the vicinity declined substantially, and by 1994 there was no evidence that grizzlies had moved out to the feedlot site north of Choteau. In two instances a grizzly bear preyed on sheep that were left outside the fenced bedding ground during the night.

In addition to existing electric fence systems, two sheep bedding grounds, a remote pig rearing facility, and two more apiaries were protected with high power electric fences located in the Dupuyer Creek and Teton River drainages on private land in Management Zone B areas. Electric fence systems were built in cooperation and cost-share agreement with livestock operators, beekeepers, and MFWP.

Two apiaries were re-established near the Teton River that had been abandoned eight years earlier due to repeated bear damages. Permanent electric fences were built around these new apiaries in June 1994. The cost of a permanent electric fence system protecting a standard beeyard (12 m by 12 m) is approximately $ 750.00 in materials (Figures 3 and 4). Labor and costs were shared with beekeepers. Estimated labor expenses are $ 240.00 @ 24 hrs (3 mandays).

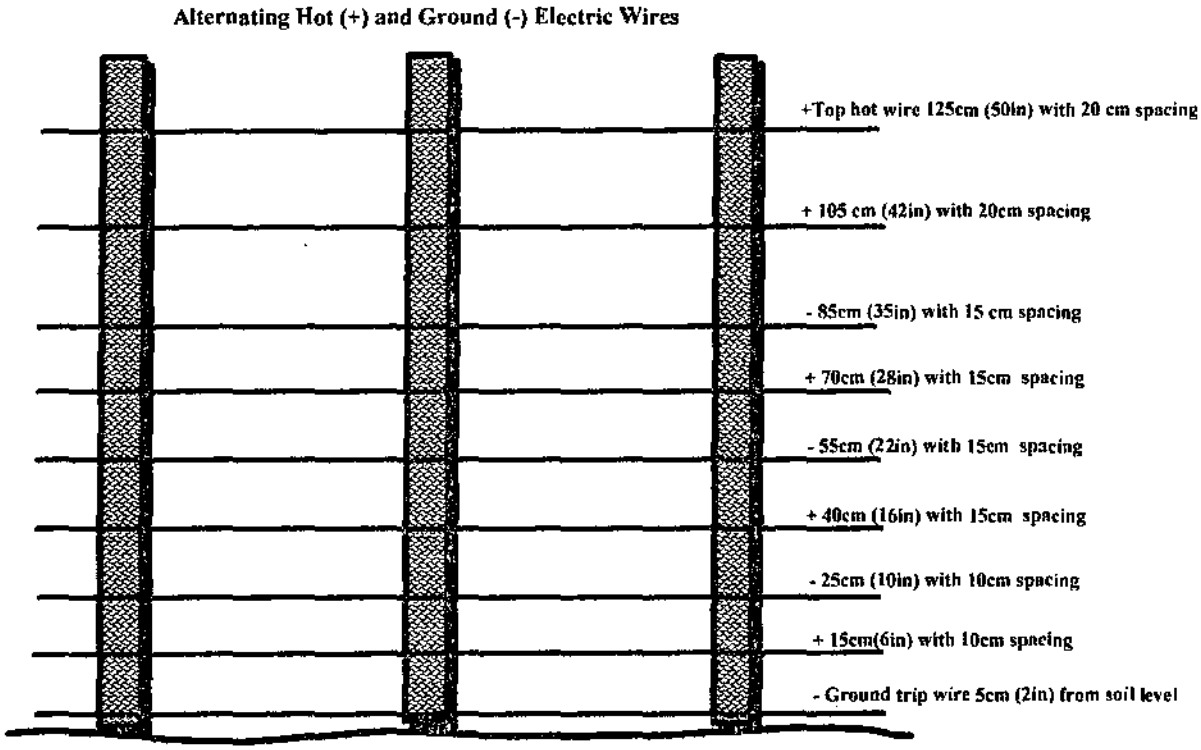
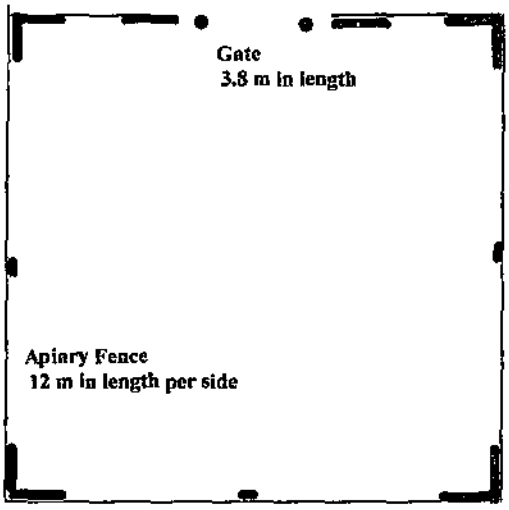


Figure 3. Permanent electric fence system design A; for preventing damage to apiaries by grizzly bears on the Rocky Mountain Front.



Alternating Hot (+) and Ground (-) Nine-Wire Electric Fence System

Materials:

- Treated wood brace posts
- Wood in-line posts
- Wood brace rails
- High tensile smooth wire
- Insulators for wood posts
- Doughnut insulators for line ends
- Rapid wire tighteners
- Wire taps and sleeves, connections
- Fiberglass gate posts and gate closer
- Ground rods
- Solar panel mounted on beebox
- Gallagher B150 fence energizer
- Deep cycle 12v battery

Figure 4. Ground schematic of permanent electric fence design A.

Prior to being protected with electric fences, the two sheep operations and pig feeder had each been repeatedly visited by grizzly bears in previous years resulting in numerous depredations, including the capture and relocation of five bears (4 females and one male grizzly). After the three fence systems were built depredations entirely ceased while livestock were inside electric enclosures. Of five bears captured and relocated from these sites, four returned to their home ranges and were monitored near to fenced attractants. In one instance, on 8/22/92, while a band of sheep were trailing back to one fenced bedding ground late in the evening (2230), a single grizzly attacked and preyed on 7 sheep, less than 1 km from the electric fence..

Cost in materials for a one hectare sheep bedding ground electric fence system is approximately $1250.00; and $ 1100.00 for a 1.2 ha pig rearing facility, including solar panel and deep-cycle 12 v batteries with each (Figure 5). Livestock operators shared with MFWP in both the construction and costs for fence materials. An estimated five mandays or 40 hrs is required to build a one ha enclosure.

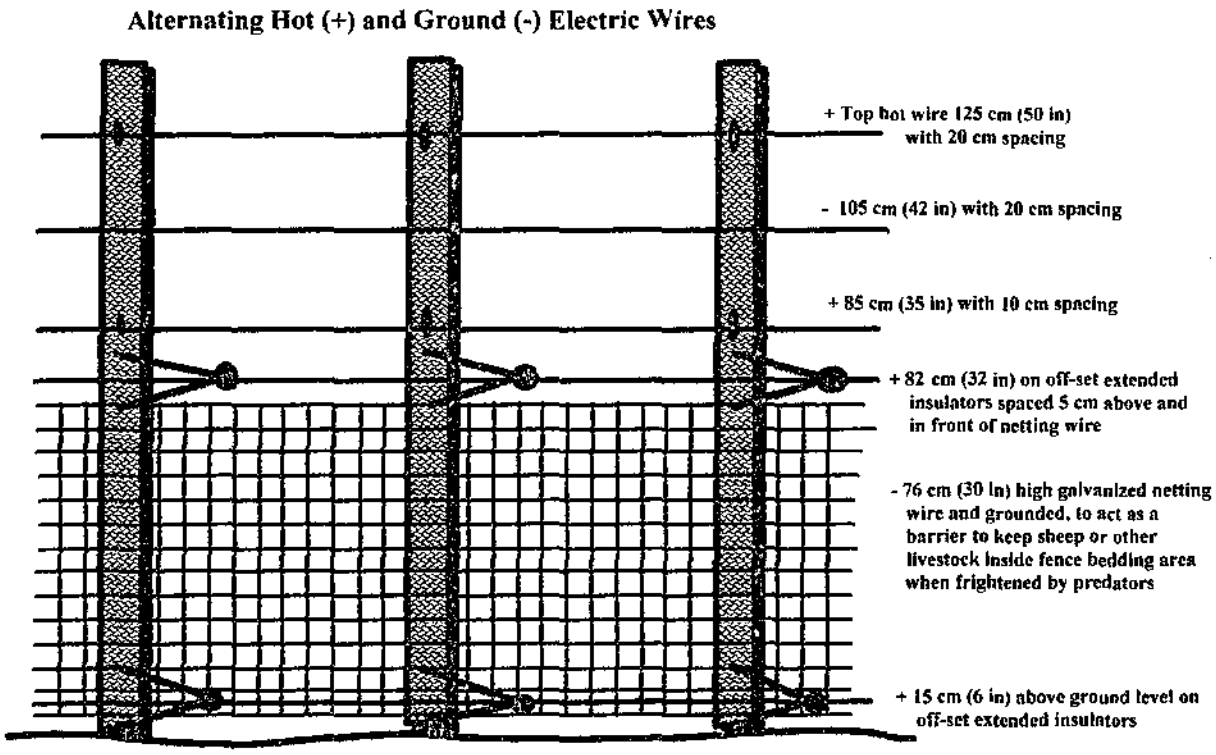


Figure 5. Permanent electric fence system design B, used around domestic sheep bedding grounds to prevent grizzly bear depredation of sheep on the Rocky Mountain Front.

Temporary electric fence systems were erected and tested in 1994 that were similar in design to our permanent fences. Temporary fences successfully protected two transient spring apiaries, moved to other sites later in June. A third temporary fence was installed around a horse carcass in a heavy bear use area on TNC's Pine Butte Preserve as an experiment to test its ability to deter grizzly access (Figure 6). The primary objective was to field test a temporary fence system under high bear-attractant conditions using an effective wire spacing and voltage level. A prerequisite to this design was that it was simple to construct, could be taken down and rolled up, and easily transported by stock for use in backcountry camp settings. Two remote cameras with heat- motion sensors were placed over the test fence and carcass to monitor potential bear visits during a 28 day period in the fall; first while the fence was in place (14 days), then after fence the was removed (14 days).

Based on field results, the temporary electric fence was 100% effective in deterring grizzly bear access during the 14 days the fence was operating. Remote photography detected a minimum of three individual grizzly bears approaching the carcass, and a fourth transmitted adult female located close to the site. It was apparent that at least two contacts with the electric fence were made by bears.

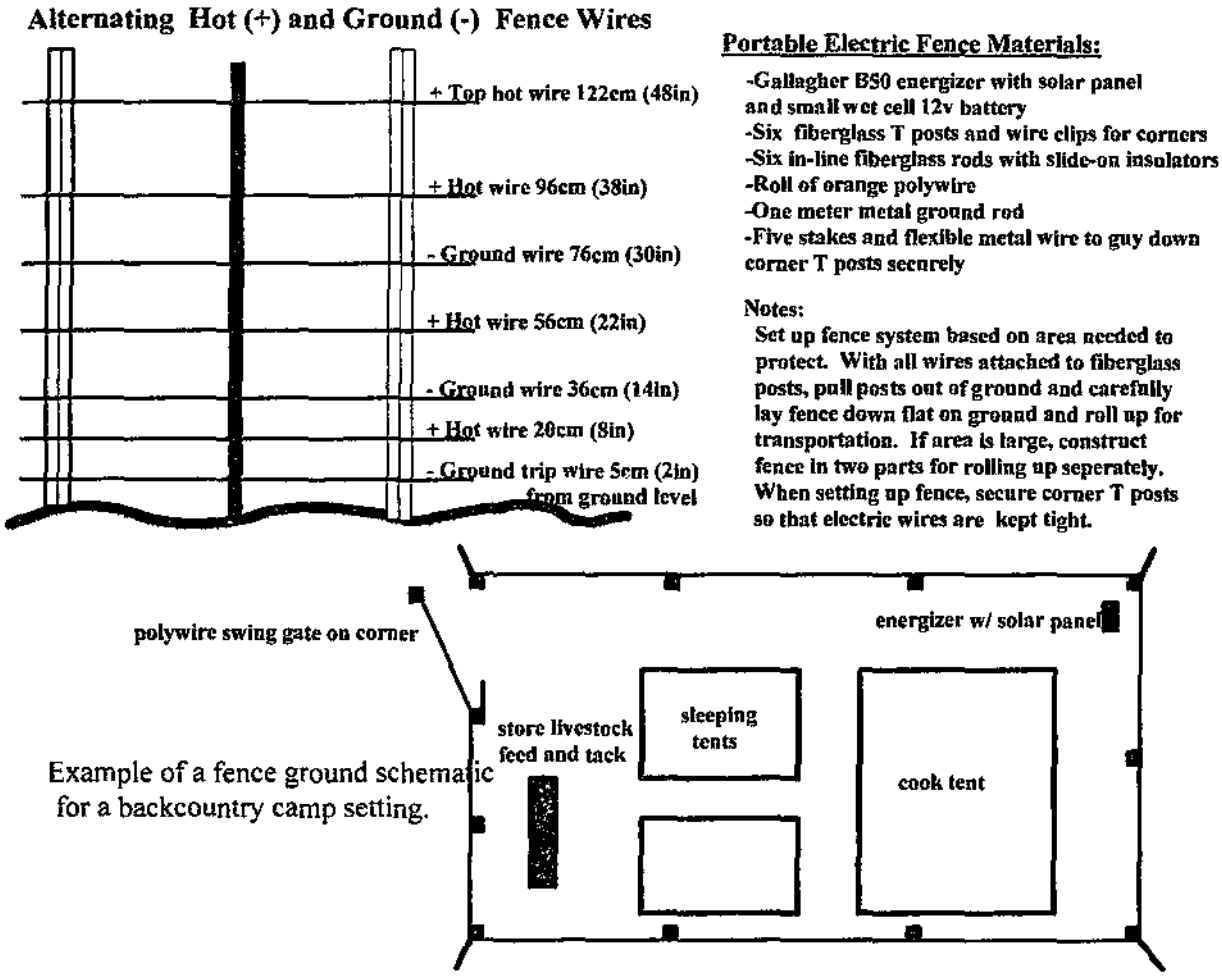


Figure 6. Temporary-portable electric fence system design C, used to prevent access and damage by grizzly bears of sites containing unnatural food attractants.

Despite the potent carcass attractant within a one meter reach, bears were unable to cross the electrical barrier (see cover photo). After the fence was removed from the site on day 15, the horse carcass was consumed within 9 days by three grizzly bears and other scavengers, as documented by photos and tracks.

The use of electricity as a bear deterrent has been tested in field applications, often with variable results. Stenhouse (1982) found that electric fences were not effective polar bear *(Ursus maritimus)* deterrents, while Davies and Rockwell (1985) were able to successfully repel the same species with a more adequate ground system. Black bears have been deterred from damaging apiaries 80 to 90% of the time in Canada (Nelson 1974, Wynnyk and Gunson 1977). Permanent electric fence systems tested on the RMF have proven to be a highly effective barrier to grizzly and black bears, involving some of the worst case bear attractant situations that exist. When properly maintained, electric

fences deterred bears 100% of the time, eliminated bear damage, and reduced other related bear-human conflicts. The types of electric fences used on the RMF were relatively inexpensive when compared to heavy chain link fences or subsequent labor intensive management control actions.

Fence design, voltage output, and correct grounding were important factors to ensure adequate pulse delivery through the dense fur of a bear. In dry soil conditions, a true grounded circuit was necessary for the transfer of a strong electrical "shock" to the animal. Alternating hot (+) and ground (-) wire strand placement guaranteed a full earth contact. Based on testing and observations, fence energizer voltage output should be a minimum of 6000 v with a stored energy rating of 0.5 Joules or greater (Madel 1991). Wire spacing should be no greater than 25.4 cm, and preferably less on the lower portion of a fence to assure that cubs or small bears have two narrow and tight hot +/- ground wire contact points.

Temporary electric fences designed with properties similar to more permanent systems, can be effective short term deterrent barriers for use around camps in the backcountry or ephemeral attractants. Temporary fences can be built to camp area size specifications at home base, laid down and rolled up for lightweight transportation between two manty packs on stock or by vehicle. Costs are relatively inexpensive, ranging between $ 350.00 to 400.00 depending on the size of the enclosure. It is important with temporary systems that energizers of at least 0.5 Joules along with a small solar panel be used. Fences with low voltage energizers (500 to 4000 volts and less than 0.5 Joule) and all positive wire systems tested on a limited basis as deterrents to bear damage of apiaries had poor results on the RMF (Madel, MFWP memorandum 1986).

Propane Scareguns

Propane operated scareguns were used as acoustic deterrents to bear-livestock and apiary conflicts, and occasionally near to residences. Scareguns were used a total of 506 gun/night locations (average 126 gun/night locations per year), most often during the spring months and tapering off in autumn. Sheep bedding grounds that had experienced depredation or had a high probability of predation due to repeated observations of bears in the area were equipped at times with a scaregun. Apiaries located east of the recovery area that had received beehive damage were also set up with scareguns.

Guns were adjusted to fire at 10 to 15 minute intervals during the hours of darkness. The noise generated by scareguns was a single loud explosion in timed sequence, from a distance sounding much like the discharge of a high-powered rifle. Improved propane gun models (manufactured by Zon Export Co.) were equipped with tripods that elevated the gun off the ground one meter, which amplified the sound and allowed the entire assembly to swivel around in a slow arc. At a distance, the swiveling action of a gun sounded as if the explosion was moving or dynamic (Figure 7).

Mechanical timers were used with each propane gun set to automatically activate and deactivate the unit at a desired time. The use of timers reduced the amount of labor required to maintain scareguns over a 10 day period, while also conserving propane fuel. The costs of a entire unit in 1994 as described includes $249.00 for the scaregun, $105.00 for tripod, and $180.00 for the automatic timer.

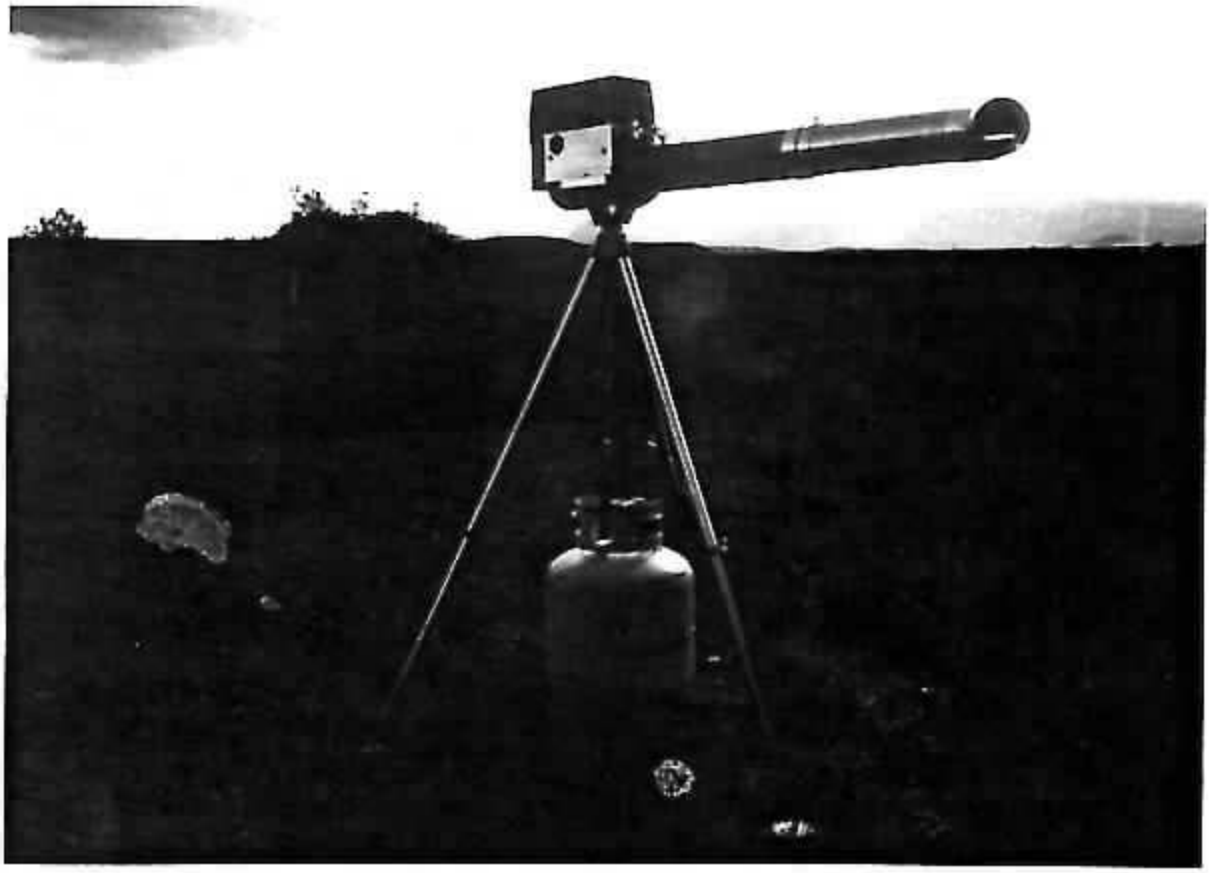


Figure 7. Propane operated scaregun swivel mounted on tripod.

Most sites that propane guns were set at experienced grizzly bear conflicts the evening prior to scaregun placement. In all cases where guns were operating, additional livestock losses or beehive damage were prevented. The use of propane operated scareguns as a method of bear deterrent, or in more general terms the use of remotely generated noise in prevention management is a relatively new concept. Bromely (1985) discussed the variable response displayed by polar bears towards cracker shells and airhorns as immediate delivery systems. When used to protect confined situations scareguns are effective in discouraging bears from approaching a site. Guns were less effective the larger the area to be protected. At some distance bears seem to tolerate the recurrent noise in order to access a known food source (Madel 1991). Although inexpensive to operate, scareguns must be maintained, can fail mechanically, and are only a temporary measure for certain perennial conflicts.

Activated Repellents

The use of more direct forms of aversive conditioning as preventative measures were limited within the scope of the RMF grizzly bear management program. Due to time and manpower restrictions few opportunities existed to employ and test manually activated conditioning methods, including plastic slug projectiles and fire cracker shells fired from a twelve gauge shotgun, or plastic bottle projectiles filled with liquid fired from a large bore "thumper gun".

Behaviorally, RMF grizzly bears tended to avoid people when involved in conflict situations, and were primarily nocturnal in their movements. Since 1986 we have made numerous attempts to

conduct aversive conditioning on grizzly bears, usually late at night, using either a thumper gun or twelve gauge shotgun. In most cases, firecracker shells were fired in a last attempt to repel bears from a conflict site because there were no opportunities to deliver physical painful stimuli.

Six aversive conditioning attempts were made over the four field seasons, of which only two situations provided opportunities to make contact with a target animal. In one case, a subadult black bear near a private cabin was hit twice at a distance of 25 m with plastic slugs followed immediately by a cracker shell explosion directly behind the running animal. In this case the bear did not return to the cabin site but did cause additional conflicts in another residence area, exhibiting food conditioned behavior. The second case was also of a food conditioned black bear being hit once with a deterrent round followed by several cracker shells accessing a walk in cooler at guest ranch. The bear ran up into some timber and did not return.

As described in earlier progress reports (Madel 1989), we found that aversive conditioning using active repellents can be used to prevent removal of some bears from the ecosystem. Under some situations, free-ranging grizzly and black bears may be conditioned to avoid people and specific sites within their home ranges. It was evident in our field trials that aversive conditioning was relatively ineffective where bears had been repeatedly food rewarded, or food attractants continued to be available.

In national park situations, Hunt et al. (1987) describe the difficulties and extensive amount of time involved in a single aversive conditioning trial using the thumper gun system. Plastic slugs and firecracker shells have been used successfully to repel polar bears (*Ursus maritimus)* and brown bears away from outpost camps and communities in the Northwest Territories, where bears were quite visible (Clarkson 1989).

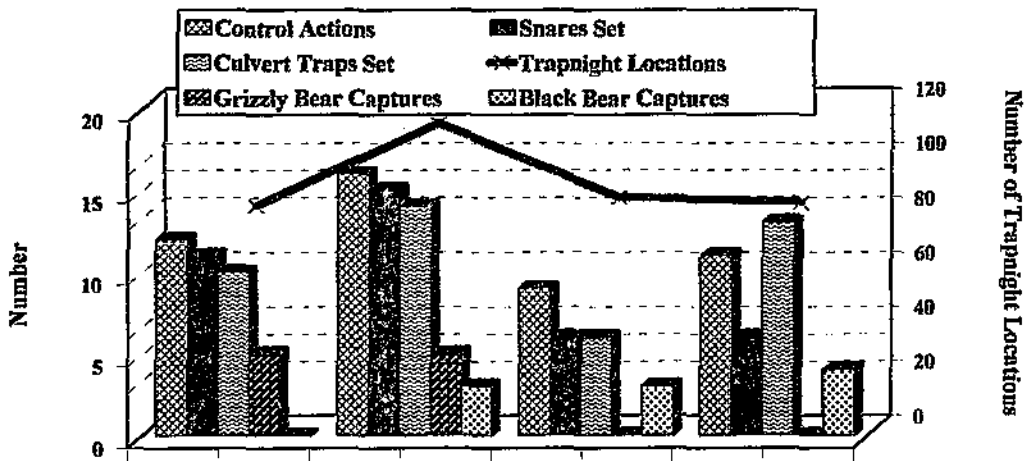
Livestock-guard dogs offer a promising alternative to other forms of predator repellent methods, particularly for protecting domestic sheep in areas where bands are moving in open range conditions. Two specific guard dog breeds, the Great Pyrenees and Akbash Dog, are well suited for defending sheep from bears and wolves (Green et al. 1984). These dogs are large bodied, bond well with a given band of sheep, and when working two dogs together can aggressively deter bears from accessing sheep.

From the few sheep operators that used guard dogs on the RMF (n=4) depredations from all predators were reduced by at least 50% (personal communication with sheep operators). In two cases where sheep growers who previously experienced recurrent grizzly bear predations purchased guard dogs (Great Pyrenees, and Akbash Dog), annual losses were substantially reduced 75 to 90%. In Montana and other western states, guard dogs have reduced bear depredation on sheep (Green and Woodruff 1989).

Control Actions

Control and Capture Events

The number of control actions taken varied annually and were directly related to fluctuations in bear-people conflicts. A total of 48 control actions were conducted in the RMF area during the report period (average 12 control actions/year) using culvert traps, steel cable snares, and free-range immobilization methods. Control events using traps and foot snares accounted for a total of 342 trapnight locations (average 86/year); a decline of 13% from the preprogress report period average (Figure 8). Traps were set in 43 locations and snares in 38 locations for a mean of seven days per



	1991	1992	1993	1994
Control Actions	12	16	9	11
Snares Set	11	15	6	6
Culvert Traps Set	10	14	6	13
Trapnight Locations	77	107	80	78
Grizzly Bear Captures	5	5	0	0
Black Bear Captures	0	3	3	4

Year

Figure 8. Number of control actions between 1991 and 1994 in the Rocky Mountain Front BMA.

control event. There were no helicopter capture attempts compared to ten events prior to 1991. Control actions were conducted through interagency consultation and cooperation between MFWP, USFWS, USDA Animal Damage Control for livestock depredations, and USFS on federal lands.

Conflict related bear captures decreased 52% from the preprogress report period; from an average of 10.4 total bear captures/year between 1986-90 to 5.0 captures/year from 1991 to 1994. Grizzly bear captures decreased from 5.6/year to 2.5/year. Twenty bears were captured at conflict sites,

comprised of ten grizzly and ten black bears (Tables 2 & 3). One unmarked adult male grizzly was an incidental capture and released on site. Additionally, five nuisance grizzly bears captured west of the Continental Divide were relocated to the RMF, but not included in the analysis. Another thirteen young orphan black bears were handled, marked, and placed in dens in the BMA as a reintroduction project discussed in the population management section.

Table 2. Grizzly bears captured in the Rocky Mountain Front BMA between 1991 and 1994.

Capture Date	Bear No.	Sex	Age	Weight in kg (lbs)	Zoological Length in cm (in)	Chest Girth in cm (in)	Pelage Color	Fat Level	Capture Location	Conflict Situation/Outcome
7/11/91	149	M	5.5 yrs	145 (320)	171 (67.3)	111 (43.7)	Brown silvertip	3	Blackleaf Creek	Residential feeding on livestock carcasses; relocate to west NCDE, returned with no further conflicts; assumed alive
7/11/91	148	M	2.5 yrs	91 (201)	155 (61.0)	90 (35.4)	Blond w/ brown legs	2	Blackleaf Creek	Residential, property damage; management removal to zoological garden
9/10/91	144	F	4.5 yrs	147 (325)	179 (69.3)	117 (46.1)	Blond w/ dark brown legs	3	Dupuyer Creek	Livestock depredations; relocated west NCDE, returned w/ no further conflicts; assumed alive
10/5/91	136	F	2.5 yrs	134 (295)	184 (72.4)	112 (44.1)	Blond w/ dark brown legs	5	Teton River	Sheep depredation; relocated west NCDE returned w/ no further conflicts; assumed alive
10/6/91	137	F	2.5 yrs	166 (365)	187 (73.6)	126 (49.6)	Blond w/ dark brown legs	5	Teton River	Sheep depredation w/ sibling #136; relocate separately westside NCDE; returned, no further conflicts, and assumed alive
7/11/92	154	M	3.5 yrs	114 (251)	170 (69.9)	97 (38.2)	Light brown w/ dark brown legs	2	Teton River	Residential and property damage; relocated short distance east NCDE, returned to area but caused no further conflicts, known alive
8/10/92	Unmarked	M	8.5 yrs	*	202 (79.5)	*	Dark brown	4	North Fork Sun River	Incidental capture, released on site, assume to alive
8/11/92	518	F	12.5 yrs	136 (300)	171 (67.3)	*	Medium brown	3	Cabin Creek	Repeated campsite/property damage/encounter conflicts exhibiting food conditioned behavior; bear #518 captured with two 2-yr old young, were removed fro the NCDE; 518 euthanized
8/11/92	156	F	2.5 yrs	100 (220)	170 (66.9)	*	Medium brown	4	Cabin Creek	Repeated campsite/property damage/encounter conflicts exhibiting food conditioned behavior; offspring of bear #51 sent to research facility
8/11/92	157	F	2.5 yrs	102 (225)	165 (65.0)	*	Blond w/ dark brown legs	4	Cabin Creek	Offspring of bear #518, fate same as with sibling #156

* information not collected

Table 3. Black bears captured or relocated in the Rocky Mountain Front BMA, 1991 to 1994.

Capture Date	Bear No.	Sex	Age	Weight in kg (lbs)	Zoological Length in cm (in)	Pelage Color	Capture Location	Conflict Situation/Outcome
7/18/92	155	F	4.5 yrs	57 (126)	140 (55.1)	Brown	Mortimer Gulch	Campsite/encounter; relocated east NCDE, did not re or cause further conflicts; assumed alive
8/29/92	158	F	4.5 yrs	45 (99)	124 (48.8)	Black	Cutbank City limits	Residential; relocated to east NCDE, did not return t area and caused no further conflicts; assumed alive
9/17/92	151	F	1.5 yrs	40 (88)	118 (46.5)	Brown	Near City of Conrad	Residential; relocated to east NCDE; hunter mortality fall 1992
9/16/93	162	M	3.5 yrs	89 (196)	164 (64.6)	Black	Sun River	Residential/encounter; relocated short distance east NCDE, and no further conflicts; hunter mortality fall 1994
9/26/93	Unmarked	M	4.5 yrs	*	*	Brown	Teton River	Residential/encounter; management handling mortali
9/28/93	159	F	2.5 yrs	59 (130)	137 (53.9)	Brown	Dupuyer City limits	Residential; relocated short distance east NCDE, hun mortality at 2nd conflict in fall 1993
5/9/94	167	F	3.5 yrs	70 (154)	138 (54.5)	Brown	South Fork Teton River	Residential/property damage; relocated east NCDE; hunter mortality in spring 1994
5/17/94	168	M	4.5 yrs	104 (229)	176 (69.3)	Black	North Fork Teton River	Residential; relocated east NCDE; hunter mortality ir spring 1994
7/21/94	169	F	2.5 yrs	41 (90)	123 (48.4)	Brown	Teton River	Residential; relocated short distance east NCDE; hun mortality fall 1994
8/30/94	170	M	3.5 yrs	91 (200)	154 (60.6)	Brown	Monarch area, MT	Residential/exhibiting food conditioned behavior; relocated to east NCDE; hunter mortality in fall 1994

* Information not collected or unknown

Six of the ten grizzlies captured were female bears and four males; of which three were adults and seven subadults. The mean age for adults was 8.5 years, and for subadults 2.5 years. Four female grizzlies had previous nuisance history and were captured for the second time. Seven grizzlies were captured by foot snares, and three by culvert traps. Five bears were relocated from conflict sites various distances, and four bears were removed from the population. Conflict types that nuisance grizzly bears were involved in include: three unrelated males were near residences on private lands, and two caused property damage after having become food conditioned; a family group of three female bears (#518, 156, 157) were raiding camps and causing property damage on LCNF lands displaying extreme food conditioned behavior; two related females (#136, 137) and another female bear (144), caused livestock depredations.

Of ten black bears captured six were females and four males, with all ten in the subadult class; a mean age of 3.5 years (Table 3). Seven black bears were captured by culvert traps and three by free range immobilizations. Three bears were recaptures with past nuisance history. Nine black bears were relocated short distances from conflict sites. Most black bear captures were residential conflicts near cabins on private lands (8), many associated with property damage. One black bear capture was campground related and one an encounter on public land, both displaying food conditioned behavior.

Bear Relocations

Twelve grizzly bear relocations were conducted during the four year period, either out or into the RMF area. Relocations involved eleven individual bears, consisting of seven females and four males, of which two were adults, eight subadults, and one yearling. Over half of the relocations were made in the fall season (58%). Four RMF bears were relocated varying distances west of the Continental Divide (to Puzzle Creek. 50 km, and as far as the Whale Creek. 177 km), and one bear a short distance (39 km) on the RMF. Six relocations were of nuisance grizzlies captured west of the divide and moved into the RMF, and one relocation was from Blackfeet Indian Tribal lands of the northeast NCDE.

The average distance relocated for all bears was 104 km (65 miles), with RMF grizzlies moved further (109 km) than west side bears (99 km). Although the report period sample size is small, the distance relocated in the NCDE appeared not to factor into whether or not a bear returned to its home range area. All five of the RMF grizzlies were known to have returned to the Front BMA and did not cause additional conflicts. Three of the west side NCDE grizzlies remained in the RMF area with no further conflicts, while three west bears returned to near their original capture sites and caused additional conflicts. Eight or 67% of the relocations were considered successful based on a relocated bear not causing additional conflicts for a two year period following its translocation.

The number of RMF grizzly bear relocations declined between 1991-94, and decreased from the previous 5 year average by 71%. In pooling the RMF data with all other documented relocations in the NCDE, Riley et al. (1995) found that relocations were only 44% successful, and that the ecosystem was not large enough to preclude bears from returning to their home range areas. Although our reported four year relocation success was higher, other trends tended to be similar. The process of relocating grizzly bears long distances to the west side of the ecosystem were expensive and time demanding. If control capture actions must be used over prevention measures, then short distance bear relocations will in most cases remove the immediate problem from the vicinity of the site and allow for preventative methods to be implemented.

Nine black bears were relocated short distances on the RMF (average 53 km/relocation).
All nine bears were subadults and tended to remain in the relocation areas outside of estimated natal home range. It is likely that relocated nuisance black bears were more vulnerable to hunter-caused mortality. Seven bears were harvested by hunters (78%), primarily during the fall hunting season, and two bears were alive as of 1995. In the context of legal mortality and reducing bear-human

conflicts, black bear relocations were 89% successful. Yet with both black and grizzly bears the objectives of relocations were not to place bears in stressful or vulnerable environments either with people or other bears, but to resolve an immediate conflict from reoccurring, and employ prevention methods where applicable.

Conflict Management Allocation

Grizzly bear zone management allocations implemented in 1988 as part of the regional program continued to operate during the progress report period towards meeting program objectives (Appendix A). Bear management zones were used regularly to prioritize bear-human conflict areas; concentrating management operations and effort proactively into prevention projects such as the reduction of livestock boneyards, protection of apiaries, and phasing out of refuse dumps in zone B areas (Figure 9).

Grizzly bear conflict situations that occurred outside the recovery area in management zone D were quickly responded to and resolved. Extended public relations work was accomplished in these zones with local people and communities towards becoming more informed regarding grizzly bears and developing acceptance of bears as their wild and rarely observed neighbors. Additionally, allocated population and habitat management strategies improved interagency cooperation towards providing secure seasonal grizzly bear habitat on public and private lands, while minimizing the potential for bear-human conflicts.

A significant number of conflict incidents occurred in seasonal fringe areas on private lands, many of these areas in the high priority management zones B and D (Table 4). Twenty four percent of

Table 4. Distribution of grizzly bear-human conflicts by MFWP Bear Management Zones and Federal Management Situations in the Rocky Mountain Front BMA.

	No. Grizzly Bear Conflicts	Percent of Grizzly Conflicts
Mgmt. Zone A	14	18%
Mgmt. Zone B	19	24%
Mgmt. Zone C	2	3%
Mgmt. Zone D	19	24%
Mgmt. Situation 1	23	29%
Mgmt. Situation 2	0	0
Mgmt. Situation 3	0	0

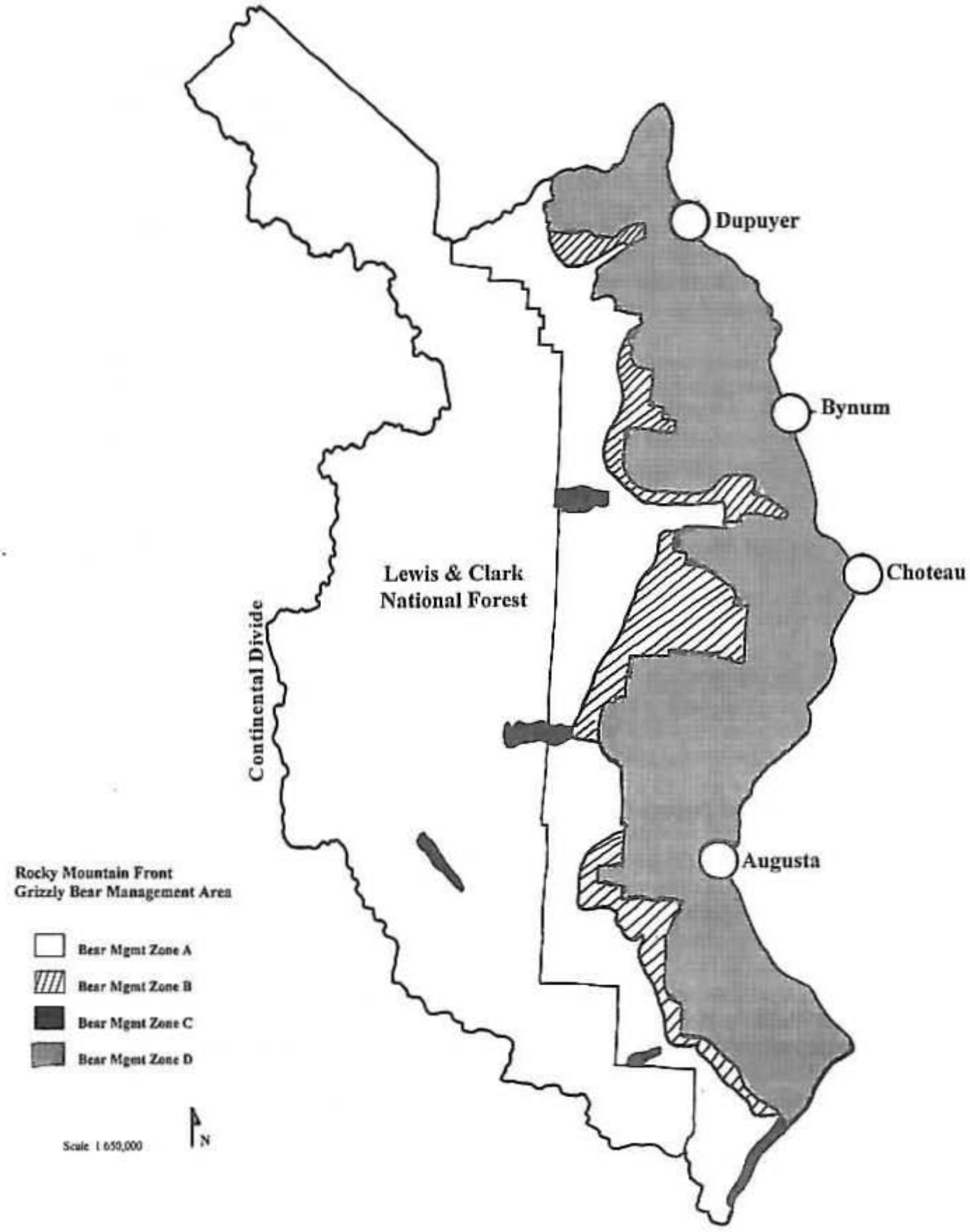


Figure 9. Grizzly Bear Management Zones in the Rocky Mountain Front BMA.

all grizzly bear conflicts were located in zone D outside the federal recovery area, and combined with zone B, close to half (48%, n=38) of all grizzly bear-human conflicts took place near or outside of the recovery line (Figure 1). Zones A and C contained fewer conflicts at 18% and 3 percent. On the Lewis & Clark National Forest, 29% (n=23) of all grizzly conflicts occurred in Management Situation 1 areas.

Of the bear-human conflicts reported with known outcomes (n=114), 74 percent were resolved in the first response by applying preventative measures or control actions. Additional conflicts by bears occurred at 26% of the incident sites until resolved. By 1994, few bear-human conflicts experienced recurrent problems, primarily as a result of zone management allocation.

The concept of zone management has been successfully used at a broader scale in other states for black bear hunting management (Hygnstrom and Hauge 1989) and for wolf (*Canis lupus*) conflict management (Fritts et al. 1992). The Interagency Grizzly Bear Guidelines provide management direction for land use activities and nuisance bear guidelines on federal lands by implementing land allocations defined under Management Situations (IGBC 1987).

Analysis Summary of Bear-Human Conflicts

Grizzly and black bear conflicts were summarized and compared with nine year conflict trends between 1986-1994. A more detailed analysis was conducted on bear-human conflicts from the four year progress report period, 1991 through 1994, based on additional data gathered at each conflict site. Although sample sizes were limited to the four year period, the results provide a better understanding of temporal and spatial patterns characteristic of conflicts between bears and people on the RMF. Complete data sets were not available for years prior to 1991, so that trend comparisons at a similar level of conflict analysis were not possible.

Characteristics of Bear-Human Conflicts, 1991-1994

A total of 136 bear-human conflicts were reported between 1991-1994, of which 79 (58%) were confirmed as grizzly bear conflicts, 29 (21%) were black bear conflicts, and 28 (21%) were mistaken for bear but caused by other wildlife species or undetermined.

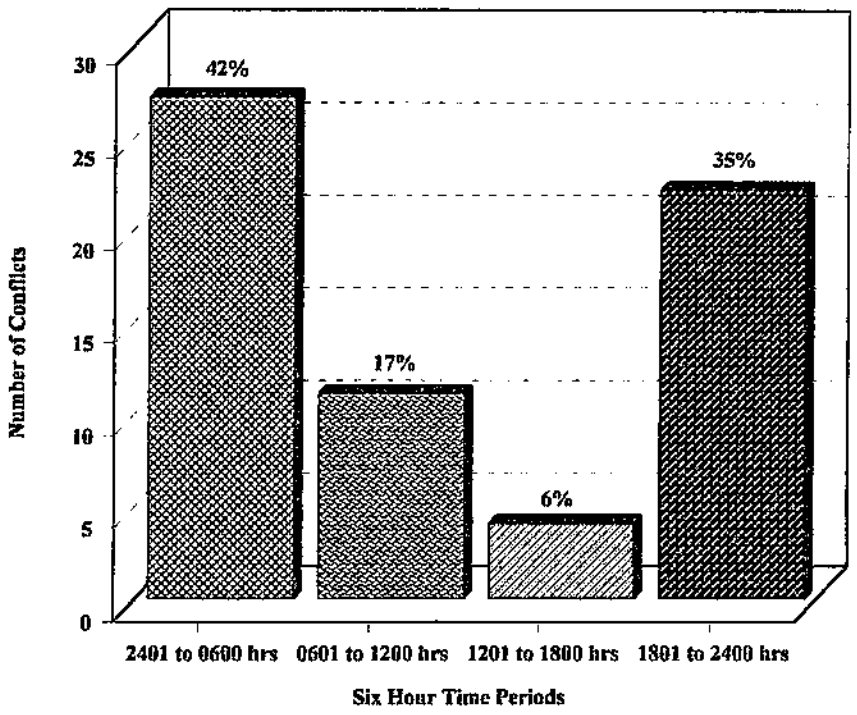
Temporal and Spatial

Bear conflict incidents were analyzed by seasonal periods that generally followed the phenological development of important plant foods. Surprisingly, the least number of grizzly bear (14%, n=11) and black bear conflicts (20%, n=5) occurred in the spring (April 1-June 30) during the four year report period. Conversely, over half of all grizzly and black bear conflicts took place in the brief summer period (July 1-August 31) at 54% (n=43) and 51% (n=12). The remaining 32% of grizzly conflicts (n=25) and 29% black bear (n=7) took place during the fall months (September 1-November 30).

The time at which bear conflicts occurred within a 24 hour period was compared using four time periods; where time period 1 = 2401 to 0600 hours, time 2 = 0601 to 1200 hours, time 3 = 1201 to 1800 hours, and time 4 = 1801 to 2400 hours. Of 65 determined grizzly conflict times, 42% occurred

in time period 1, 17% in time 2, 6% in time 3, and 35% in time 4 (Figure 10). Based on time periods combined with exact time data for certain conflicts, nearly 75% of grizzly conflicts took place during the hours of darkness or brief crepuscular periods.

Figure 10.
Occurrence of grizzly-human conflicts by six-hour time periods.



The use of darkness as a form of cover by grizzlies was evident when located in open habitats and near to human activity on private land. All livestock depredations and 84% of residential conflicts occurred in time periods one and four. Black bear conflict times were more diurnal than grizzly conflicts, with over half occurring in time periods two and three, often in the middle of the afternoon. Of 19 known black bear conflict times, 26% took place in time period one, 21% in time two, 38% in period time three, and 16% in time four.

Based on land ownership patterns, 69% (n=54) of all grizzly bear-people conflicts occurred on private lands, and the remaining 31% (n=24) took place on Lewis & Clark National Forest lands. There were no grizzly conflicts on State or Bureau of Land Management (BLM) lands, though frequently used by grizzly bears. The number of grizzly conflicts doubled on federal LCNF lands compared with the previous five years, 1986-1990, while private land conflicts decreased 20%. Ninety two percent of black bear conflicts (n=22) occurred on private lands, and 8% (n=2) on the LCNF.

The distribution of grizzly bear conflicts in the RMF BMA were analyzed by NCDE Bear Management Units (BMU) (Figure 11). Several conflicts occurred just outside the east boundary

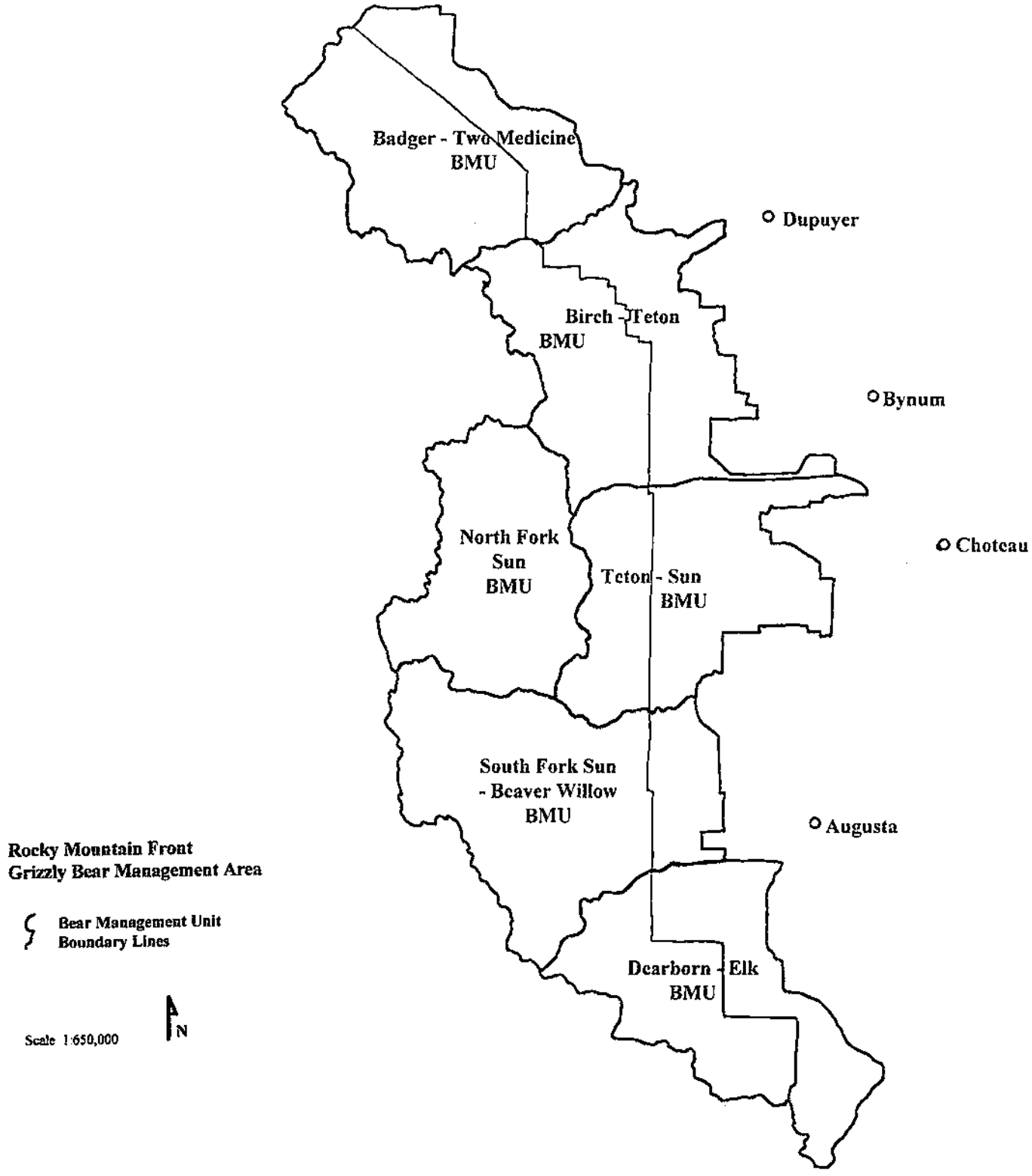


Figure 11. Grizzly Bear Management Units in the Rocky Mountain Front BMA.

of a BMU, and were included in that BMU if its location was 1 km or less from the line. Out of the six RMF BMU's, the Birch-Teton, Teton-Sun, and North Fork Sun River contained the highest percentages of grizzly conflicts, 34%, 20%, and 21% consecutively (Table 5). The South Fork Sun-Beaver/Willow, Dearborn-Elk, and Badger-Two Medicine BMU's all contained less than 10% conflict incidents.

Table 5. Distribution of grizzly bear-human conflicts by Bear Managements Units in the Rocky Mountain Front BMA.

	No. Grizzly Bear Conflicts	Percent Grizzly Conflicts
11. Badger-Two Medicine	2	3%
15. Birch-Teton	26	34%
17. North Fork Sun	16	21%
18. Teton-Sun	15	20%
21. South Fork Sun-Beaver Willow	6	8%
23. Dearborn-Elk	4	5%
00. Outside BMU Boundries	7	7%

Bear-Human Conflict Types and Behavior Patterns

To accurately assess nuisance grizzly bear situations, nine types of bear-human conflicts were defined on the basis of attribution or motive for which people reported conflicts with bears. Conflict types include; 1. *encounter*, 2. *residential*, 3. *campground*, 4. *property damage*, 5. *livestock depredation*, 6. *beehive damage*, 7. *crop feeding/damage*, 8. *human injury*, and 9. *bear injured* (Appendix A for definitions).

Each bear incident was categorized by conflict type, and if applicable assigned up to two different conflict types. For example, on 7/10/92 a grizzly bear reported next to a ranch home during the night leaving its large tracks on a window (residential) also tore the seat off a motorbike parked outside (property damage); yet the landowners did not report that the same bear had also accessed garbage in an open shed near the house, and had received a food reward (behavior interaction). Most bear conflicts involved a primary category type (I) and a secondary conflict type (II), that together better represented cause and effect relationships. Combining conflict type categories I and II caused overlap in the analysis (greater than 100% of the total), yet displayed more accurate patterns in bear-human conflicts in the RMF area.

Grizzly bear conflicts were highest in *residential* (46%, n=36), followed by 34% *livestock depredations* (n=27), 27% in *property damage* (n=21), 19% *campground* (n=15), 11% of *encounters* (n=9), 9% *beehive damage* (n=7), and one *bear injured* (Figure 12). There were no grizzly caused *crop damages* or *human injury* conflicts during the report period. The two most common combinations of grizzly conflict types that occurred together in an incident were *campground/property damage* and *livestock depredation/residential.*

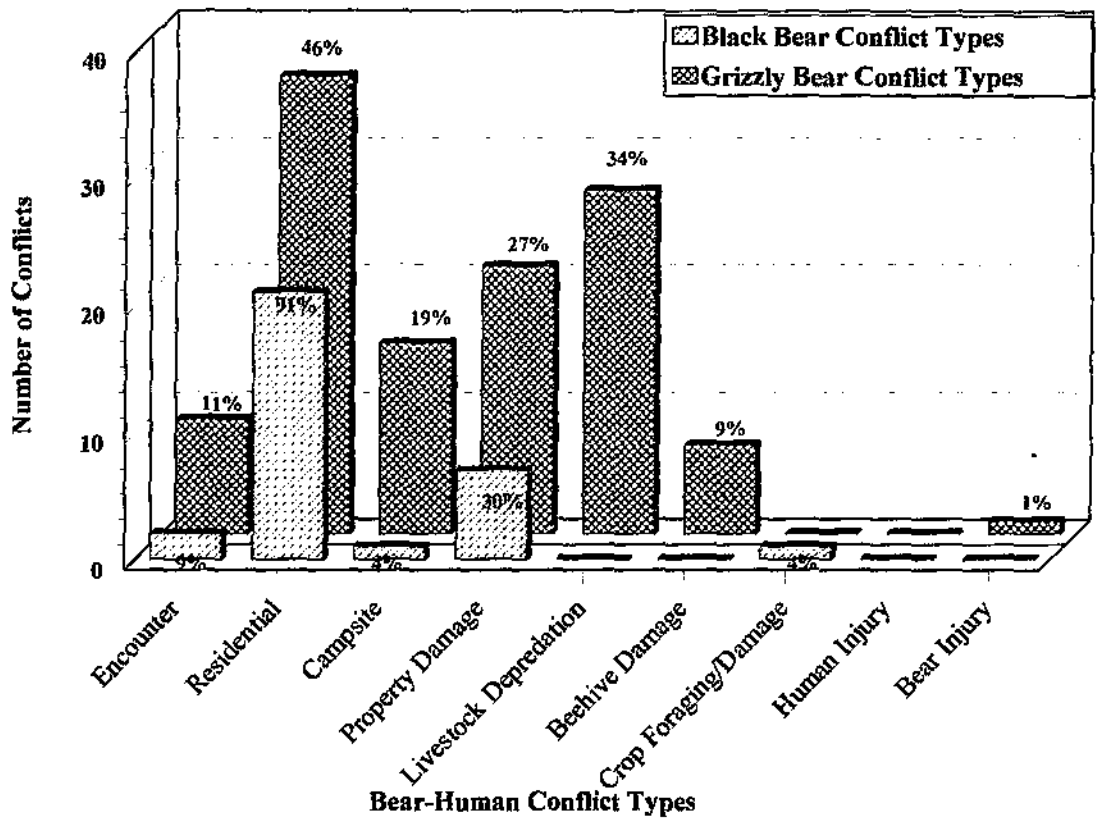


Figure 12. Bear-human conflict types between 1991 and 1994 in the Rocky Mountain Front BMA.

Black bear conflict types differed from grizzly, with no *livestock depredations* or *beehive damages*, while *residential* conflicts were greater at 91% (n=21), followed by 30% *property damage* situations (n=7), 9% *encounters* (n=2), and single *campground* and *crop feeding/damage* incidents.

Surprisingly, over 40% of grizzly conflict incidents involved more than one bear at the site. Of 78 known incidents 11% involved two grizzly bears, 30% with three bears, and 4% involved four bears at a conflict site. As expected, many bear groups were related subadult bears or adult females with young (n=29). Single black bears caused conflicts more frequently (83%) than with litters or in groups.

Grizzly bear conflicts were analyzed by observed or determined bear behavior categories for each incident to evaluate possible correlations between type of displayed behaviors and incident outcome or interactions (Hastings et al. 1989). Three behavior categories were used for an analysis, including; behavior *type*, behavior *interaction*, and behavior *response*. Each category was further defined as a set of behavior types or effects (Table 6). Definitions were similar between certain conflict types and behavior category effects in order to assess behavioral patterns, thus conflict types were kept separate from the analysis.

Table 6. Bear conflict behavior category definitions for the Rocky Mountain Front.

I. Behavior Type	
1. Wariness/Fear	Bears exhibit fear, flee human presence, or/and avoid being in near proximity to peo
2. Habituated	Bears exhibit tolerance of people and human activity at closer distances, and remain proximity of people.
3. Food-conditioned	Bears exhibit a learned association between unnatural foods and people, attempt to a obtain human foods while in the near proximity to people.
4. Predatory	Bears prey or attempt to prey by pursuing livestock or other domestic animals, whicl include humans.
5. Unknown	Behavior type was not observed or could not be determined at the conflict site.
II. Behavior Interaction	
	1. Bear(s) obtains unnatural foods.
	2. Bear searches yard, camp, conflict sites (spend time at conflict site; digs, daybeds.
	3. Bear causes property damage.
	4. Bear foraging on natural foods in near proximity to people or dwellings.
	5. Bear causes or attempts livestock depredation.
	6. Bear approaches people.
	7. Bear charges people, including both bluff charges and those resulting in physical
	8. Bear physically attacks people resulting in human injury of fatality.
	9. Bear is injured or fatally wounded by people during a conflict incident.
	10. Unknown or undetermined behavioral interaction
III. Behavior Response	
	1. Bear(s) flees human presence (fear/escape).
	2. Bear is wary, but remains in area (neutral)
	3. Bear approaches people (nonaggressive)
	4. Bear charges people defending itself, offspring, or food source (defensive aggress
	5. Bear charges or attacks people in a unprovoked manner (aggression)
	6. Unknown or undetermined behavioral response.

The *type* of grizzly bear behavior displayed at conflict sites was often dictated by behavioral interactions during an incident. Four behavior types were evenly represented, with *wariness/fear* displayed in 24% of the conflicts, *habituation* 22%, *food conditioned* 24%, *predatory* (livestock) 23%, and 8% were undetermined (Table 7). Black bear behavior category results are not presented due to limited data, but are summarized are in Table 7.

Table 7. Summary of bear conflict behavior categories by conflict incidents between 1991 and 1994.

Bear Conflict Behavior Category	Black Bear Incidents	Grizzly Bear Incidents	Percent of Black Bear Behavior Incidents	Percent of Grizzly Behavior Incident
Behavior Type				
1. Wariness/Fear	5	19	21%	24%
2. Habituated	7	17	29%	22%
3. Food Conditioned	12	19	50%	24%
4. Predatory	0	18	0	23%
5. Unknown	0	6	0	7%
Behavior Response				
1. Bear flees human presence (fear/escape)	3	12	13%	15%
2. Bear is wary, but remains in area (neutral)	8	26	33%	33%
3. Bear approaches people (nonaggressive)	8	13	33%	17%
4. Bear displays defensive-aggression (charge)	2	4	8%	5%
5. Bear displays unprovoked aggression (charge/attack)	2	1	8%	3%
6. Unknown	1	23	5%	27%
Behavior Interaction; Categories I & II combined				
1. Bear obtains human or livestock foods	11	23	46%	29%
2. Bear searches/digs in yard or campsite area	4	13	17%	17%
3. Bear causes property damage	8	26	33%	33%
4. Bear foraging on natural foods in vicinity of people of dwellings	7	9	29%	11%
5. Bear causes or attempts livestock depredation	0	26	0	33%
6. Bear approaches people	1	5	4%	6%
7. Bear charges people	2	5	8%	6%
8. Bear physically attacks resulting in human injury/fatality	0	0	0	0
9. Bear is injured by people	0	1	0	1%

Grizzly conflict incidents were assigned up to two behavior *interactions* when applicable (similar to conflict type analysis), so combined interaction categories I and II resulted in percentages that exceeded 100 percent. Coinciding with conflict types results, the two most common grizzly behavioral interactions were; *bear causes or attempts livestock depredation* (33%, n=26) and *causes property damage* (33%, n=26). Notable was that grizzlies *obtained human or livestock foods* in 29% of the incidents (n=23), *searched yard or camps* 17% (n=13), and were *foraging on natural foods near to people or dwellings* 11 percent (n=9). In the case of encounters, bears directly approached people 6% (n=5) of the incidents, charged people 5 times, and one bear was physically wounded by people. In 6% of the incidents bears *approached people* (n=5) and *charged people* (n=5), and one *bear injured* occurred when a bear was shot at close range when it charged people.

Bear behavioral *response* was difficult to identify at conflict sites, and as a result 27% of the incidents were undetermined. Grizzlies were known to *flee from human presence* (fear/escape) in 15% (n=12) of the incidents, while in 33% (n=26) bears exhibited *wariness but remained in the area* (neutral). In 16% (n=13) of the conflicts bears were not wary and *approached people* nearby (nonaggressive). In four situations (5%) bears displayed *defensive aggression* behavior and charged people, and in one case a grizzly charged people in an *aggressive unprovoked* manner.

Behavior categories were analyzed together to examine possible correlations between certain classes. In most behavior category queries, one or two combinations of paired classes accounted for greater than 50% of primary category incidents. Although sample sizes were small at this analysis level for significant results, the two paired-behavior combinations are described to emphasize relational patterns. As expected, when bear behavior type *wariness/fear* was compared with response classes, *bear flees human presence* (47%, n=9) and *bear is wary but remains in area* (42%, n=8) accounted for nearly 90% of the five classes. *Habituated* behavior type associated with responses *wary but remains in area* accounted for 53% (n=10) and *approaches people* 18 percent (n=3). *Food conditioned* behavior type associated with *approaches people* accounted for 53% (n=10), and *wary but remains in area* 21% (n=4) of the conflicts. *Predatory* behavior displayed by grizzly bears was not associated with other interaction in 61% of the incidents (n=11).

Grizzly behavior type was correlated with combined behavior interaction categories I and II. Of interest, the association of *wariness/fear* with interaction class *causes or attempts livestock depredation* accounted for 37% (n=7) of the 19 wariness/fear incidents, and *bear feeding on natural foods in vicinity of people or dwellings* in 21 percent (n=4). The interaction *bear causes property damage* combined with all *habituated* type incidents accounted for 47% (n=8), and 24% (n=4) with *bear searches yard or camp area. Food conditioned* behavior showed a strong correlation with interactions *obtains human or livestock foods* and *causes property damage*, both at 74 percent (n=14). As expected, *predatory* linked 100% with grizzly *livestock depredations* (n=18), and 17% with *searches yard or camp area* (n=3).

Researchers Herrero (1985) and Gilbert (1989) have discussed associations grizzly bears develop between humans and food through learned behavior and positive reinforcement. The correlations in our results, though limited to four years of data, displays a strong relationship between food

conditioned behavior leading to potentially serious situations such as bears approaching or charging people and causing property damage. In most cases, bears that were food conditioned were also habituated to the smell or sight of people, while often bears that were habituated only tended to be more wary of people but remain in the vicinity of the conflict. These types of behaviors appear to predispose some grizzlies to act more aggressive towards people and cause human injury (Herrero 1989).

Livestock depredations are rarely acceptable to people who's way of life is agriculture, yet our results tend to show that grizzlies that kill livestock are the least likely have confrontations with humans or cause other types of conflicts. Several adult female bears that previously killed livestock, were captured and relocated, have returned to the Front and still alive in the population because of preventative methods. The most significant conflict management implication for the RMF is to prevent bears from gaining access to anthropomorphic foods in all front and backcountry areas.

Livestock Depredations

A total of 47 bear conflicts were reported as livestock depredations between 1991 and 1994 (36% of all conflicts), of which 26 incidents were verified as grizzly bear caused or attempted depredations (55% of reported depredations). Reported depredations confirmed as not-bear related were natural mortalities or caused by other wildlife predators, including coyotes (*Canis latrans),* mountain lions (*Felis concolor),* and golden eagle (*Aquila chrysaetos).*

Of 26 grizzly bear caused livestock depredations, 54 domestic animals were killed, averaging 2.1 animals a depredation incident, and 13.5 animals per year. Livestock animals preyed on during the four year period were comprised of 7 cattle (7 calves, 0 adult cattle), 44 sheep (37 adults, 7 lambs), and 7 pigs (Table 8). Additionally, grizzly bears caused injuries to two calves, two sheep, and one pig during attempted predations. Combined monetary losses from grizzly-livestock depredations totaled $ 9131.51; an average of $ 2283.00 annually.

Livestock were preyed on by grizzly bears annually between April and October but tended to have seasonal highs and lows in occurrence. Sheep depredations were most common during the late summer to early fall period, while calf kills occurred more often during the spring and early summer months. In relation to attractants, 13 out of 16 sheep depredations occurred while at concentrated bedding ground sites. The number of sheep preyed on by grizzly bears declined steadily over the four years from 27 in 1991 to 2 animals in 1994, primarily as a result of protecting sheep bedding grounds with electric fence barriers and in the use of livestock guard dogs (Figure 13).

Specific data categories were collected at each depredation site and analyzed for characteristics in the type of livestock prey grizzly bears selected, the methods used to prey on animals, and typical feeding patterns exhibited by bears. Physical evidence or sign of predation at a kill site were usually typical of bear. Signs of predation struggle on the ground were obvious in 57% of the incidents, and blood from prey was soaked or pooled in the soil or on vegetation in 86% of those incidents investigated in the first few days. Contrary to most opinions, rarely did grizzly bears cover livestock kills, with 93% of animal carcasses left uncovered.

Table 8. Grizzly bear-caused livestock depredations and summary statistics between 1991 and 1994, Rocky Mountain Front BMA.

	No. of Depredation Incidents	No. of Animals Killed	No. of Animals Injured	Monetary Loss	Average Annual No. Animals Killed
Cattle-adult	0	0	*	*	0
Cattle-yearling	0	0	*	*	0
Cattle-calf	7	5	*	*	1.3
Total Cattle	7	5	2	$2919.50	1.8/yr
Sheep-adult ram	6	6	*	*	1.5
Sheep-adult ewe	9	28	*	*	7.0
Sheep-lamb	1	8	*	*	2.0
Total Sheep	16	42	2	$5337.01	11.0/yr
Pigs	3	7	1	$875.00	2.0/yr
Horse	0	0	*	*	0
Poultry	0	0	*	*	0
4-Year Totals	26	54	5	$9131.51	13.5/yr

The physical condition of most livestock animals preyed upon was good to excellent based on visceral body fat deposits present, and solid bone marrow indices (at least 90%). The average age of combined livestock preyed on was 2.2 years. All cattle and pigs preyed on were less than one year of age. Adult sheep predations greater than one year-olds, averaged 3.3 years of age.

The two most common positions that intact livestock carcasses were found in after being preyed or fed on be grizzlies was *lateral*-laying on its side (36%), and *dorsal*- laying on its back with legs splayed out (25%), notably with sheep. Tooth marks and canine puncture wounds were located frequently on the *lower dorsal-neck* region (32% of carcasses) and the *upper ventral-neck/throat* region (29%), followed by the *dorsal-thoracic/back* region in 14% of the carcasses.

Claw marks were occasionally located laterally on an animals *sides* (11%), and on the *rump* region (7%). Signs of subcutaneous hemorrhage in body tissues were important indicators of predation and how an animal was killed. Muscle tissue regions in which subcutaneous hemorrhage was identified was similar to that of tooth mark locations; in the *ventral-throat* tissues (39%), *dorsal-neck* (29%), and 14% in *dorsal-back* tissues above the shoulders.

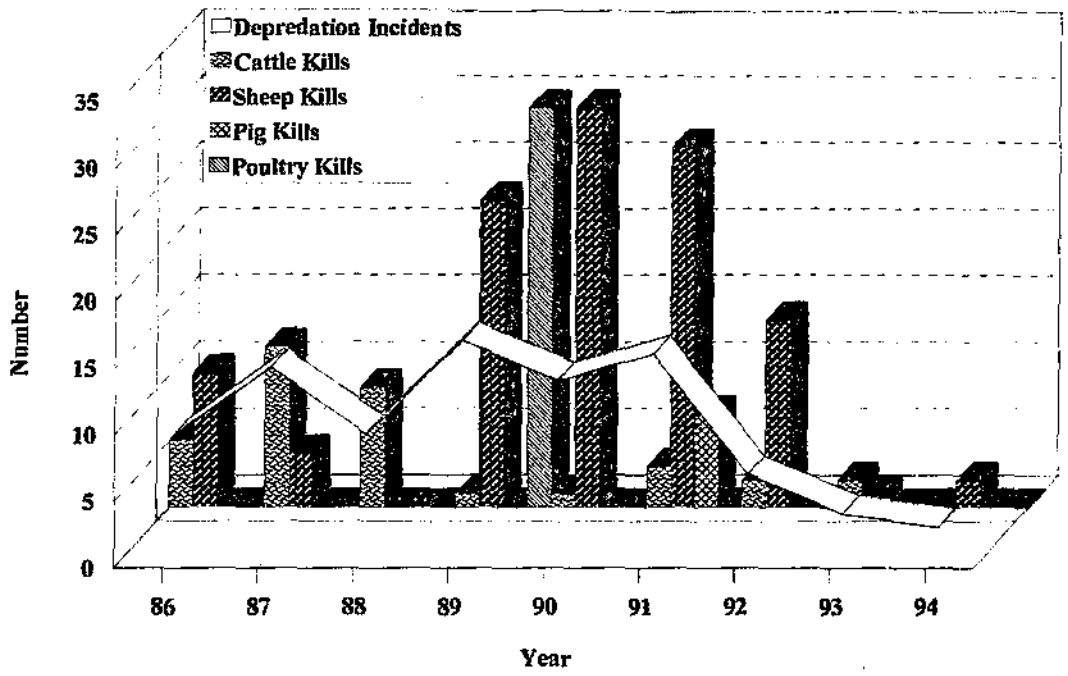


Figure 13. Grizzly bear-caused livestock depredations between 1986 and 1994 in the Rocky Mountain Front BMA.

Information collected at each predation incident was evaluated to determine the probable methods used grizzly bears to kill livestock. Of five kill classes, the most recurrent means of kill was a severe bite(s) to an animals lower cervical or thoracic vertebrae, causing separation and severe damage, as in 51% of the depredations. A second common method of predation was a bite(s)/strangulation hold to the throat region causing severe bleeding and trauma. There was no evidence that bears killed livestock by powerful body blows, and in 11 percent of the kills, method of predation could not be determined due to extent of feeding.

Carcass feeding patterns by bears were usually distinctive, although patterns varied depending on the type of livestock being fed on. With sheep, the lipid fat deposits of the sternum and mammary glands were commonly selected first (87%) (Figure 14). With both calves and sheep, the thoracic and abdominal viscera were fed on extensively (39%), while the tissue regions of the inner shoulders and upper rear legs were eaten secondarily (39%). The amount of carcass consumed varied on whether or not multiple kills were involved at a depredation site and the length of time passed prior to investigation. Rarely did bears feed on animals that were still alive (4%). In most situations where moderate to extensive feeding had occurred, carcasses were skinned back, with the hide pulled and rolled down intact leg bones, which was highly characteristic of bear feeding.

Figure 14. Adult sheep depredation by grizzly bear displaying typical carcass feeding pattern and body position.

In the RMF area, domestic sheep are the most selected livestock prey animal used by grizzly bears. Grizzly bears will locate and kill sheep wherever they occur unprotected in occupied bear habitat, and flocks are particularly vulnerable in their bedding grounds during the night. Results have shown that sheep and smaller livestock can be effectively protected from large predators through the use of electric fence systems and guard dogs. Electricity and dogs can be used to immediately deter bears as well as provide pain induced stimuli towards modifying predation behavior in other similar situations.

Surprisingly, few adult cows are preyed on by grizzlies in the management area, although cattle are the most abundant domestic livestock on nearly all private ranchlands and throughout allotments on federal lands. We have observed adult cows chasing grizzly bears away from herds through open grasslands. The risk of injury to a small or medium sized bear being kicked by adult cattle may be greater than the benefits of attempted predation. Most cattle depredations are caused by adult male grizzlies or larger bears that have learned a technique of ambushing cows with calves along mountain trails.

Livestock depredations on the Blackfeet Indian Reservation, located north of the RMF reported significantly greater adult cattle predations by grizzly bears (8 cows, 1 bull) between 1991 and 1994 (Carney 1995 memo.). Occupied grizzly habitat on the reservation is less than half of the RMF area

yet it appears that adult male bear densities are higher, and extensive aspen (*Populus tremuloides)* stands provide better ambush-type habitat for cattle depredations. Similar patterns of cattle predations have been documented in southern Alberta, resulting in several grizzly bear mortalities and relocations to other areas in the province (Nagy and Gunson 1990).

Methods that grizzly bears used to kill and feed on livestock on the RMF differed from methods described by Wade and Browns (1985) and Roy and Dorrance (1976). These investigators found that grizzlies often kill livestock by blows to the frontal region of prey, drag their kill into cover before feeding, and characteristically cover carcasses with soil and vegetation. Based on the RMF results and tens years of observations, bears always killed livestock by severe bites to the neck, back or throat; and rarely did bears cover livestock kills or move kills more than a few meters. Because many livestock kills occurred in open prairie habitats at night, grizzly bears might not have adequate ground materials or security cover to conceal prey remains. In some situations where bears fed on livestock prey undisturbed for several days, carcass remains were partially buried.

Nine-Year Summary Trends in Bear-Human Conflicts, 1986-1994

During the nine year period 1986 through 1994, a total of 358 bear-human conflict complaints were received and investigated in the RMF BMA. Of this total 64 percent (n=229) were confirmed as grizzly bear conflicts, 22 percent (n=79) were black bear conflicts, and 14 percent were mistaken for bear and caused by other wildlife species or undetermined (Figure 15).

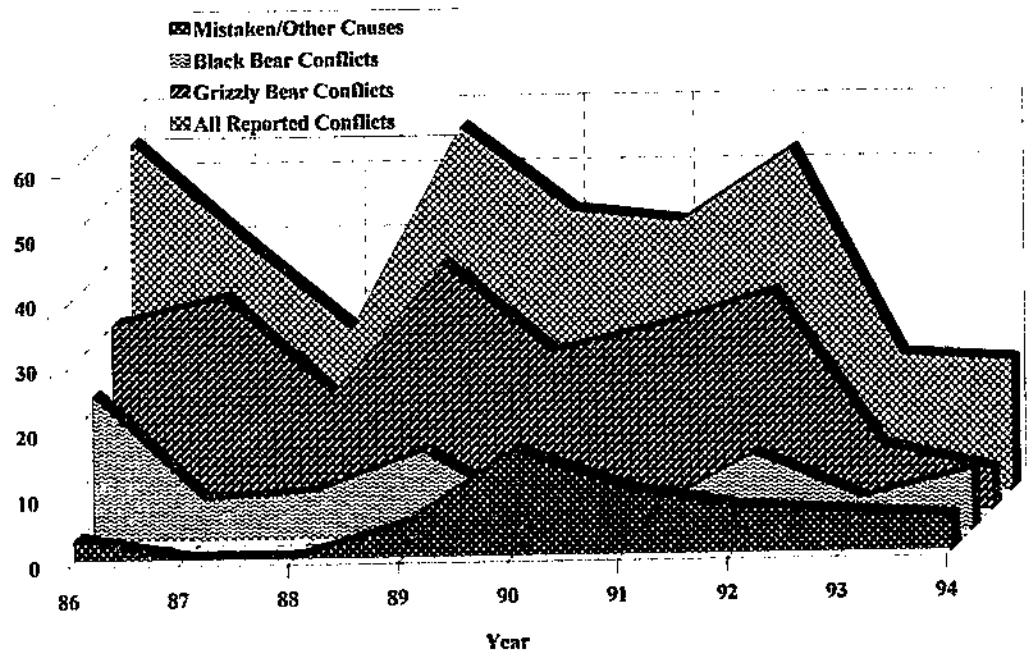
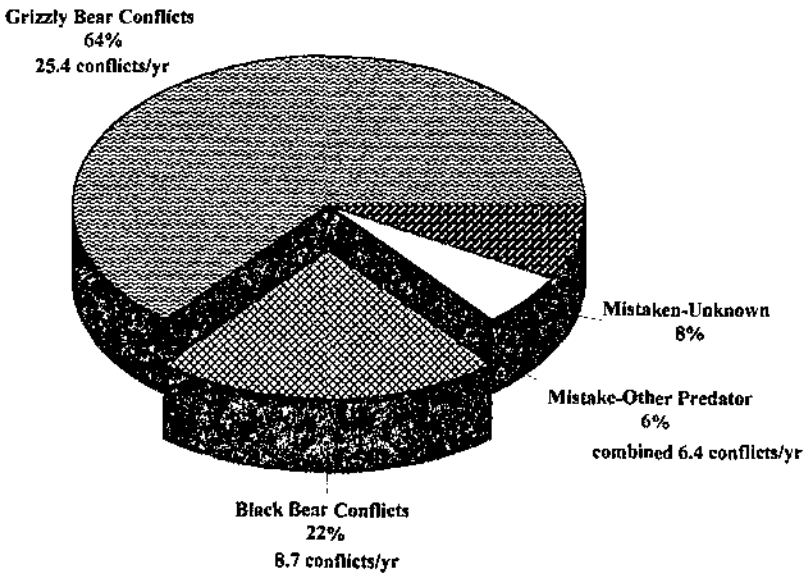


Figure 15. Nine-year summary of bear-human conflicts in the Rocky Mountain Front BMA, between 1986 and 1994.

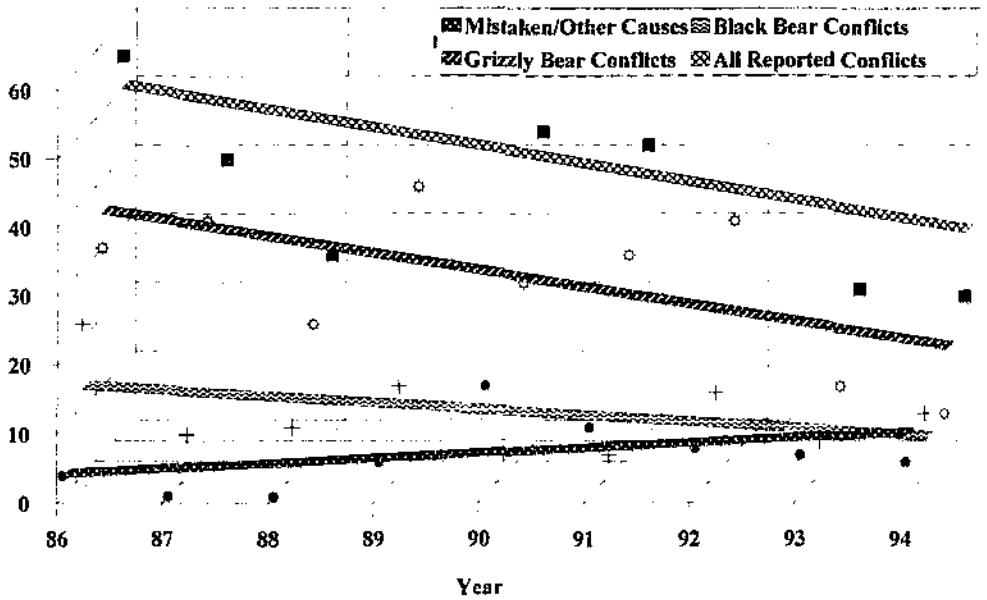
There was an average of 40 bear-human conflicts reported annually, of which 25 were grizzly conflicts, 9 black bear conflicts, and 6 incidents were mistaken or unknown (Figure 16).

Figure 16. Nine-year averages of bear conflict classes between 1986-1994.



The number of annual bear-human conflicts during the nine year period were lowest in 1994 and 1993. Although total conflicts varied widely year to year, grizzly bear conflict incidents decreased 34% from the preprogress report period average of 29.8 conflicts/year (1986-1990) to 19.8 conflicts/year (1991-1994). Black bear conflicts decreased 27% from 10.0 conflicts/year to 7.3 conflicts/year (Figure 17).

Figure 17. Nine-year trends in bear-human conflicts between 1986 and 1994, Rocky Mountain Front BMA.



The percent of conflict incidents by month was fairly consistent each year; the fall month of September being the high grizzly bear conflict month (average of 6.1 conflicts/month) followed by August and July (5.3 and 4.9 conflicts/mo respectively). Black bear conflicts peaked in the month of July (2.6 conflicts/mo), followed by August and September (2.3 and 1.9 conflicts/mo) (Figure 18).

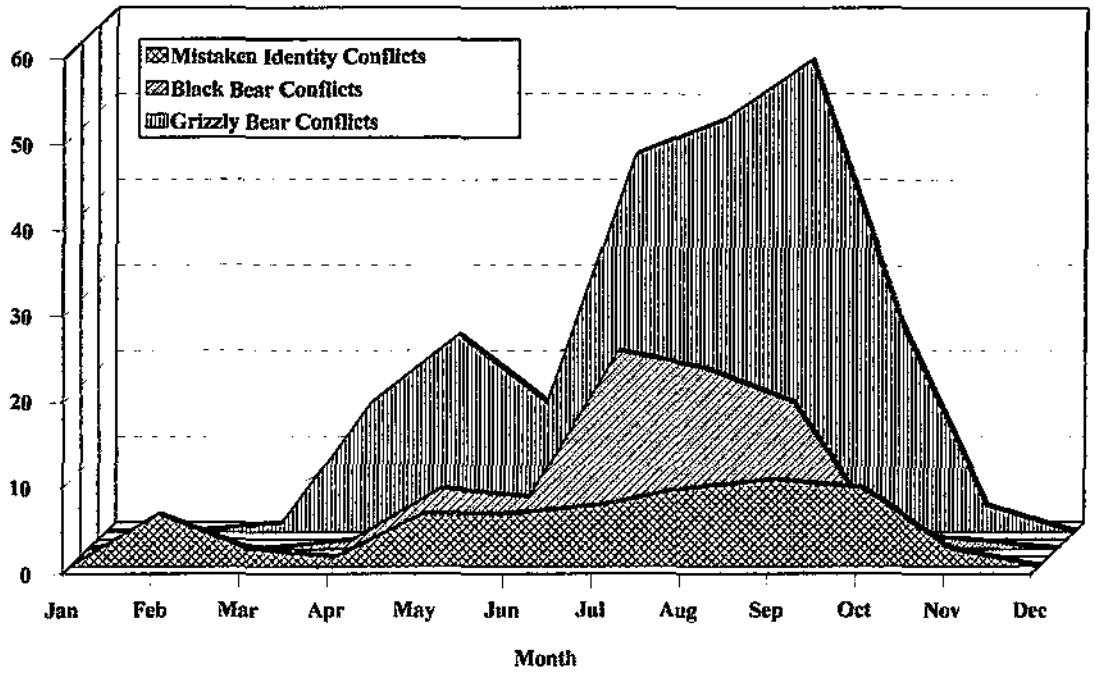
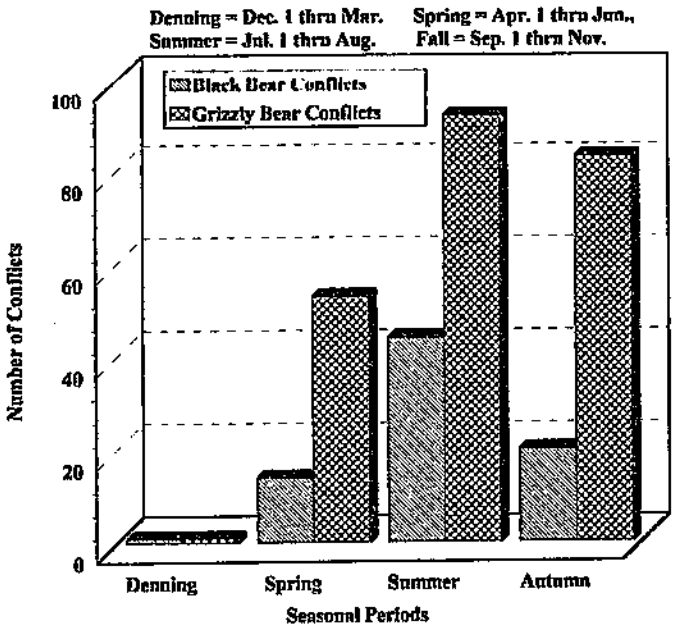


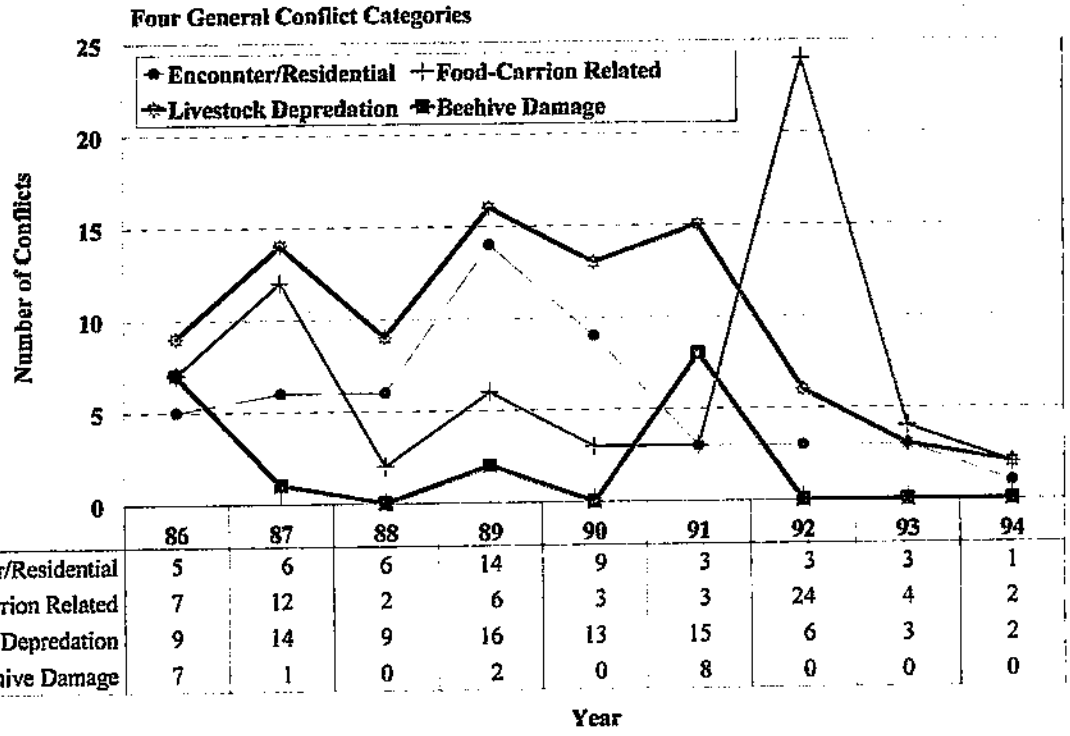
Figure 18. Bear-human conflicts by month between 1986 and 1994, Rocky Mountain Front.

We analyzed bear conflicts in relation to the seasonal periods of spring, summer, fall and denning that coincided with the phenological development of key plant foods. For both grizzly and black bears, the summer was the highest conflict season, with 40% and 56% of annual bear-human conflicts occurring in this brief two month season (Figure 19). The fall season was followed closely in the number of grizzly conflicts (36%) and less than half for black bear related conflicts (25%). Besides the winter denning period, the spring was the lowest conflict season with 23% grizzly and 18% black bear conflicts occurring in the months of April through June.

Four general conflict management *categories* were used to compare basic cause and effect differences between bear-human conflicts during the nine year period (Figure 20). Conflict management categories should not be confused for or compared with more specific bear conflict *types* that were used for the four year progress report period analysis. Conflict management categories include: *bear-human encounter* that involved bears near people or occupied dwellings and in camps where no attractants were available; *food-carrion related* that involved conflicts in camps or near people/residences that involved unnatural or natural attractants that bears fed on; *livestock depredation* involving grizzly bear predation of domestic animals; and *beehive damage* by black and grizzly bears.

Figure 19. Bear-human conflicts by seasonal periods between 1986-1994, Rocky Mountain Front BMA.





	86	87	88	89	90	91	92	93	94
Encounter/Residential	5	6	6	14	9	3	3	3	1
Food-Carrion Related	7	12	2	6	3	3	24	4	2
Livestock Depredation	9	14	9	16	13	15	6	3	2
Beehive Damage	7	1	0	2	0	8	0	0	0

Figure 20. Nine-year summary of grizzly bear conflict categories between 1986 and 1994 in the Rocky Mountain Front BMA.

Of verified grizzly bear-people conflicts during nine years, the highest proportion of incidents were 38 percent *livestock depredations* (n=86), followed by 27% *food-carrion related* conflicts (n=62), 20% *bear-human encounters* (n=46), and 8% were *beehive damages* (n=18). Black bear conflicts differed noticeably from grizzly incidents with a higher proportion of *food-carrion related* and *beehive damage* conflicts (57%, n=45 and 24%, n=19 respectively), a similar 18% *bear-human encounter* rate (n=14), and no confirmed black bear-caused livestock depredations in nine years.

Because of year to year fluctuations in bear conflict management categories, trends were analyzed by comparing averages between the four year report period and previous five years. While grizzly bear *encounters* decreased 65 percent from the 1986 to 1990 period, *food-carrion related* conflicts increased 48%, primarily as a result of a series of backcountry camp incidents during 1992 involving an adult female grizzly bear with two offspring that had become food conditioned. *Livestock depredations* decreased 45% and *damage to beehives* declined slightly.

From a smaller sample size, black bear *encounters* increased from 1.0/year to 2.3/year, while *food related* conflicts remained stable at 5.0 per year. Most black bear conflicts in the progress report period occurred in expanding subdivision areas located in the RMF foothill or mountainous regions. Black bear *beehive damages* decreased from 3.8/year to none in the last four years.

Of a total of 129 livestock depredations reported between 1986 and 1994, 67 percent were confirmed as grizzly bear-caused predations (n=89), and 33% were caused by other wildlife predators, natural mortalities, or other undetermined effects (n=43). The composition of grizzly bear-livestock kills included: 35 cattle (9 adults, 26 calves), 111 sheep (79 adults, 32 lambs), 7 pigs, and 41 geese/poultry. Cattle depredations decreased approximately 70% from the 1986 to 1990 period (6 cattle/year to 2 cattle/year in 1991-1994), and sheep depredations decreased 25% (15 sheep/year to 11 sheep/year in 1991-1994) (Figure 12). Feeder pigs and poultry depredations occurred in single year events and were protected from additional damage.

Population Management

Grizzly Bear Population Characteristics; Observation Monitoring

Adult female grizzly bears with litters were observed consistently in the RMF BMA during the four year progress report period, 1991-1994, displaying a slight increase annually (Figure 21). Annual fluctuations in the number of observed family groups were reported as being greater in earlier years 1988 to 1990 by Madel (1991), but were likely a function of inconsistent reporting methods and observation effort, and varied observers. Standard methods were employed during the report period that included repeatable observer contacts, collecting reliable observations from experienced outfitters, ranchers, biologists, and other agency personnel that work and have knowledge of RMF land areas and wildlife.

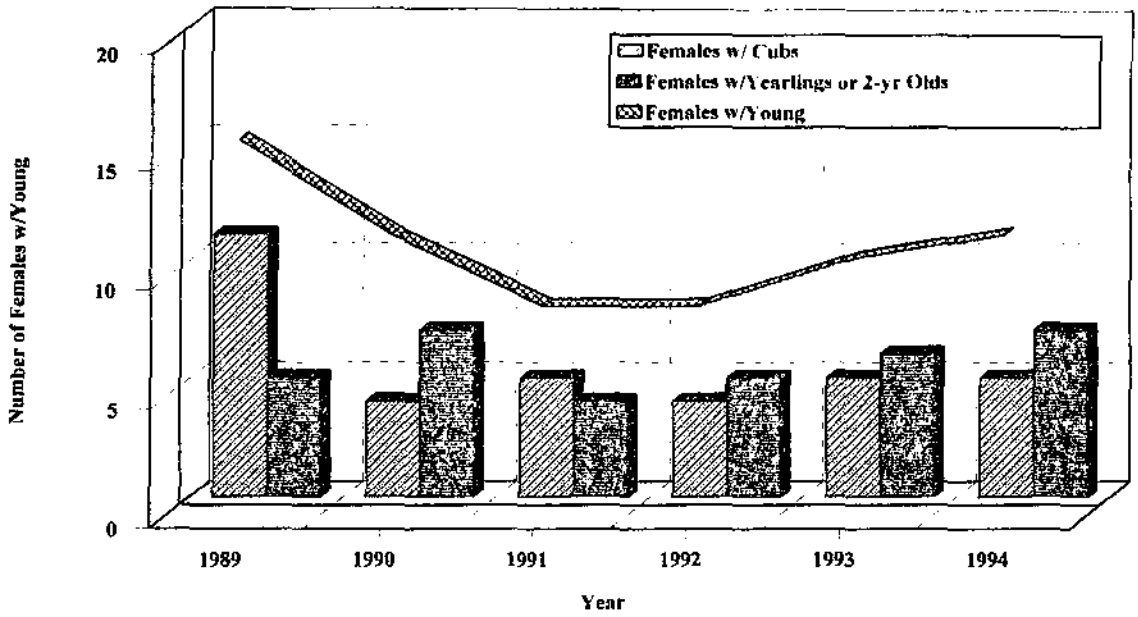


Figure 21. Observations of unduplicated adult female grizzly bears with litters during a 6-year period in the Rocky Mountain Front BMA.

A total of 41 unduplicated female grizzly bear with litter observations were reported; an average of 10 females with young/year. Nineteen observations or 46% were female bears with cubs (less than one year of age), and 22 observations of females with yearling or two-year old young (54%). Grizzly bear family groups were distributed throughout the BMA, with all six of the RMF Bear Management Units containing at least four female with young observations over the four year period (Table 9). Each BMU was occupied by at least one family group every year except for the

Table 9. Distribution of adult female grizzly bears with young observations by Bear Management Units between 1991 and 1994 in the Rocky Mountain Front BMA.

Bear Management Unit	1991	1992	1993	1994	4-Year Sum	4-Year Average
11. Badger-Two Medicine	3	1	1	3	8	2.0
15. Birch-Teton	3	3	1	1	8	2.0
17. North Fork Sun	0	1	2	2	5	1.3
18. Teton-Sun	1	3	3	3	10	2.5
21. South Fork Sun-Beaver Willow	1	1	2	2	6	1.5
23. Dearborn-Elk	1	0	2	1	4	1.0
Annual BMU's Combined Total	9	9	11	12	41	10.3

Dearborn-Elk BMU which had no sightings one out of four years. The number of observations were greater in the north BMU's and progressively less in the southern Dearborn-Elk BMU. This observation trend correlates with estimated bear densities for the RMF, where the more mesic and vegetatively diverse habitat occurs as a gradient from north to south.

A total of 32 grizzly bear cubs were observed, with an average annual cub litter size that ranged 1.40 to 2.00 cubs/litter. The average annual yearling/two year-old litter size ranged 1.40 to 2.33. The mean litter size for cubs and yearlings/two year olds over the four year sum were 1.68 and 1.77, respectively (Table 10). These figures are lower than average litter sizes of 2.20 cubs and 2.18 yearlings documented by Aune and Kasworm (1989) and less than those reported by Madel (1991) for the previous three year period. This difference could be due to a declining number of marked females in the sample, with few family groups captured or monitored in a given year. Without the contribution of capture and telemetry data, observations in the field under estimate litter size because not all cubs may be seen in one sighting.

Table 10. Observation summary statistics for adult female grizzly bears with litters during a six year period, 1989 through 1994, in the Rocky Mountain Front BMA.

	1989	1990	1991	1992	1993	1994	6-Year Sum	6-Year Average	4-Year Sum (1991-94)	4-Year Average (1991-94)
No. Adult Females with Cubs	11	2	5	4	5	5	34	5.7	19	4.8
No. Cubs	20	4	9	8	8	7	56	9.3	32	8
Average Litter Size	1.82	2.00	1.80	2.00	1.60	1.40	*	1.65	*	1.68
No. Adult Females with Yearlings/ 2-yr Olds	5	7	4	5	6	7	34	5.7	22	5.5
No. of Yearlings	10	13	7	7	14	11	62	10.3	39	9.8
Average Litter Size	2.00	1.86	1.75	1.40	2.33	1.57	*	1.82	*	1.77

Based on the past 6-year running average of RMF unduplicated females with cubs (ave. 5.7 females with cubs, 1989-1994), using the NCDE grizzly population recovery target parameters, a minimum *sub*population estimate for the RMF BMA is 99 grizzly bears, assuming a 3-year reproductive cycle (USFWS 1993). Intervals less than 3-years between litters are common in the RMF area, making the *sub*population estimate extremely conservative.

Aune and Kasworm (1989) documented a reproductive interval range of 2.3 to 2.6 years/litter, which continued to be observed after 1988 based on marked female grizzly bear cycles. Assuming that half of the RMF adult females are producing litters every two years, the adjusted minimum *sub*population estimate for 1994 would be 135 grizzly bears, based on the equation [ave. 5.7 adult females with cubs divided by 0.6 (sightability correction factor) = 9.4 females with cubs; 9.4 multiplied by 4.1 interval factor = 38.5 adult RMF females, then divided by 28.4 percent (proportion of females in population) = 135.6 RMF grizzly bears].

Other RMF grizzly observations and telemetry locations are in the process of being collated for a ten year analysis to be conducted later on bear distribution, and to discern any changes that may have occurred over time at the BMU level. Several adult female grizzly bears without cubs and adult male/female breeding pairs were also detected in the BMA both from marked and observed samples, and through remote camera photography.

Grizzly Bear Mortality

The average annual known grizzly bear mortality level for the report period is 2.5 bears/year, and ranged from 1 to 4 bear mortalities a year in the RMF BMA. The average annual female mortality was 1.0 bears/year. Of ten total grizzly bear mortalities between 1991-1994, four were females and six males, with five being adults and five subadults (Table 11). Mean mortality age for subadults was 2.5 years, and for three known adult ages was 13.5 years. Half of the mortalities occurred on private lands and 50% on federal National Forest lands (LCNF).

All grizzly bear mortalities during the four years were human-caused and included 2 illegal kills, 1 self-defense kill, 3 legal hunting mortalities, and 4 management removals. Seven bears that died had some history of conflict with people prior to the mortality incident, while three unmarked bears had none. Six bears displayed moderate to high levels of food conditioned behavior and caused property damage or encounters, resulting in four management removals (3 bears in backcountry camp conflicts, 1 bear in repeated residence conflicts), one self-defense kill of a large male bear entering camp to access livestock feed, and one bear poisoned feeding on strychnine-treated grain in an open cabin porch.

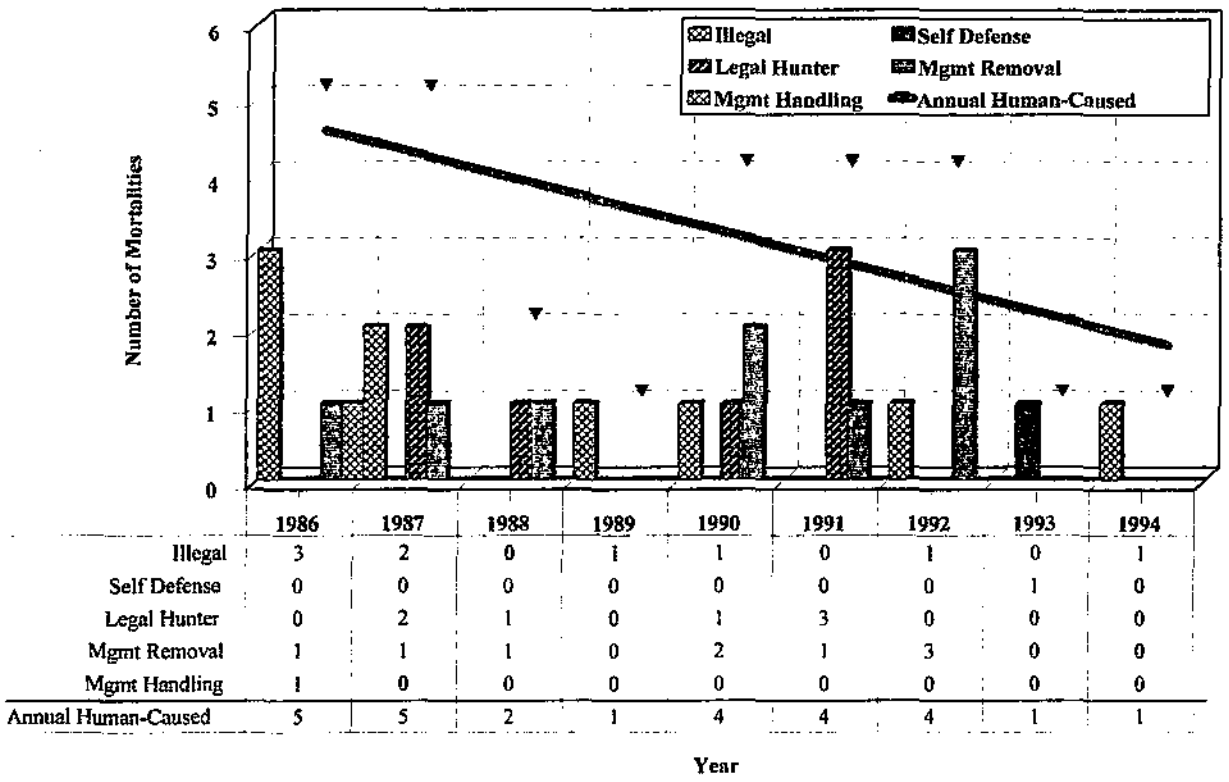
The number of grizzly mortalities declined over the report period, and decreased 31% from the five year preprogress annual average of 3.6 bear mortalities/year (Figure 22). Although the sex ratio of mortalities between the two periods was similar, the number of subadult deaths declined 46%, from 12 to 5 bears. Notable was that the proportion of illegal mortalities declined 64% from the 1986-90 average, while hunting and management removal mortalities remained stable.

Types of mortalities and corresponding percentages were similar to what Aune and Kasworm (1989) reported, with the exception that illegal kills were greater (31%) than reported for the progress period (20%). The same researchers reported average mortality levels between 1977-1988 for the entire East Front that were comparable to the preprogress period average (3.58 bears/year), although its important to note that mortalities were included from the Blackfeet Reservation, outside of the RMF BMA.

Table 11. Grizzly bear mortalities between 1991 and 1994 in the Rocky Mountain Front BMA.

Date	Bear No.	Sex	Age	Mortality Location	Conflict Type	Mortality Type
4/13/91	218	M	21.5 yrs	Teton River/ private land	Livestock predation; 1 calf killed and 1 calf injured	Hunter kill; spring grizzly bear season
4/21/91	107	M	5.5 yrs	Harrison Basin/ private land	None	Hunter kill; spring grizzly bear season
5/4/91	Unmarked	M	4.5 yrs	Sugarloaf Mtn./ private land	None	Hunter kill; spring grizzly bear season
7/11/91	148	M	2.5 yrs	Blackleaf Creek/ private land	Residential/property damage while trying to access livestock foods	Management removal; zoological garden
8/11/92	518	F	12.5 yrs	Cabin Creek/ LCN Forest	Campsite/property damage w/human foods available	Management removal; euthanized
8/11/92	156	F	2.5 yrs	Cabin Creek/ LCN Forest	Campsite/property damage w/ human foods available	Management removal; research facility
8/11/92	157	F	2.5 yrs	Cabin Creek/ LCN Forest	Campsite/property damage w/ human foods available	Management removal; research facility
9/20/92	Unmarked	M	Adult	Arsenic Creek/ LCN Forest	Property damage w/ unnatural foods available in cabin	Illegal kill; poisoned by strychnine treated rodent bai
10/3/93	Unmarked	M	Adult	Pool Creek/ LCN Forest	Encounter/bear approached person in tent with livestock foods accessible and food conditioned from other unoccupied camp w/ livestock foods	Self defense; bear shot with in a few meters of tent door
9/24/94	Unmarked	F	1.5 yrs	Sheep Creek/ private land	None-unknown	Illegal kill; bear shot at clos range with arrow projectile

Recent RMF grizzly bear mortality levels for the last two years and the 4-year average of 2.5 bears/year were well below the NCDE recovery parameter/mortality limits, based on the most recent 3-year sum of females with cub's RMF *sub*population estimate (USFWS 1993). The 3-year minimum RMF *sub*population estimate of 112 bears, at four percent mortality, defines a not-to-exceed mortality level of 4.5 bears/year (1.3 females/year at 30%). The female mortality sublimits were exceeded during a two consecutive year period (1991-92), when three female bears were removed in 1992.



	1986	1987	1988	1989	1990	1991	1992	1993	1994
Illegal	3	2	0	1	1	0	1	0	1
Self Defense	0	0	0	0	0	0	0	1	0
Legal Hunter	0	2	1	0	1	3	0	0	0
Mgmt Removal	1	1	1	0	2	1	3	0	0
Mgmt Handling	1	0	0	0	0	0	0	0	0
Annual Human-Caused	5	5	2	1	4	4	4	1	1

Figure 22. Human-caused grizzly bear mortalities between 1986 and 1994 in the Rocky Mountain Front BMA.

Hunting Management

Between fall of 1991 through 1994 there was no legal hunting of grizzly bears in the NCDE. During the early spring of 1991, a limited entry grizzly bear season was conducted in the RMF BMA over a five week period, between April 1 and May 4. Refer to Appendix C for details on objectives and structure of the spring season. Two primary goals of an early spring season compared to the fall season structure were to minimize the harvest of female bears while concentrating hunter effort and take on low elevation private lands where the majority of bear-human conflicts occur.

Three male grizzly bears were killed by permitted hunters during the five week season. Two were adult males (ages 21.5 and 5.5 years) and one was a large subadult bear (4.5 years), all of which were harvested on low elevation private lands, two in the foothills region and one bear in plains/river bottom habitat. The two adult males were marked bears and known to have a past history of conflicts with people; the old-aged bear was directly linked to calf depredations a few days prior to being shot close to the incident location.

Based on harvest results and information collected from survey questionnaires distributed to all 50

permitted hunters, the 1991 spring grizzly bear season was successful in meeting its objectives. The limited-entry season was more selective to sex and type of bear hunted by using den emergence dates and seasonal periods to develop harvest management strategies. Compared with hunting statistics for other past grizzly bear seasons (Dood and Ihsle Pac 1993), the 1991 RMF spring grizzly season implemented the highest selective hunter effort and pressure on a local grizzly population for which the state has records.

Ninety four percent of 50 permitted hunters went afield and hunted an average of 10.4 mandays specifically for grizzly bears, with 66% of hunter effort occurring on private lands. Hunters observed grizzly bears 18 times, came across grizzly tracks 29 times, and several hunters actively pursued bears that escaped. Three hunters shot at a bear, and each of these sportsmen killed the bear they shot at (Constan, MFWP memo. 1991).

In April 1991, a lawsuit was filed in Montana State Court by The Fund for Animals to halt the grizzly bear hunting season in the NCDE. The State Court ruled in favor of limited grizzly hunting management in Montana and the MFWP season structure as proposed continued. In the summer of 1991, a second lawsuit was filed against the USFWS in Federal Court (District of Columbia, Washington D.C.) by the same plaintiffs to stop all hunting of grizzly bears. Three days prior to the start of the 1991 fall grizzly season, a preliminary injunction was filed in Federal Court against the hunting of grizzly bear, and the season was canceled by MFWP Commission action. In 1992 the USFWS published an amended ESA federal rule which removed authority for states to establish hunting seasons in the lower conterminous states (Dood and Ihsle Pac 1993).

The use of hunting as a management tool is just one of several important techniques discussed in this report for the long term health and viability of a grizzly population. The loss of hunting as one specific method can to some degree be simulated by other procedures, such as focused preventative techniques to modify individual bear behavior and reduce the possibility of habituation. As has happened during the report period, the number of grizzly bears removed from the population through management control actions, and possibly human self-defense mortalities will increase over time to compensate for lack of hunting caused mortalities, especially those bears that tend to be bolder or more visible (Mysterud 1977).

It has been shown that limited-entry or restricted quota grizzly bear hunting management strategies can be successfully used to limit the number of hunting mortalities, and orient the harvest to specific sex and age classes of bears (Smith 1991, Nagy and Munson 1989). The use of restricted hunting seasons based on grizzly population and ecological parameters, and regionally tailored, can maintain bear mortalities at minimum acceptable levels while also influencing bear behavioral wariness towards people. Grizzly bears avoid areas near people after being harassed or injured, and hunting can make bears sensitive to human presence (Gilbert 1989). Additionally, grizzly bears are less likely to become habituated to people in areas where they are hunted (Herrero 1989).

Hunting mortalities for black bears in the RMF BMA during the report period, as well as information on other black bear hunting statistics and population characteristics are summarized and discussed in McCarthy (1993) and MDFWP (1994).

Black Bear - Reintroduction of Orphaned Cubs

An experimental program was initiated in 1989 to reintroduce orphaned black bear cubs back into the wild. The primary objective of the reintroduction project was to test the effectiveness of returning orphaned black bear cubs to native Montana habitats, monitoring survival rates, and if successful, using this data for similar reintroductions of orphaned grizzly bear young.

Between ten and fifteen black bear cubs are orphaned each year statewide, as a result of illegal hunter-caused mortalities of adult lactating females, and a smaller proportion of female bears are killed as a result of vehicle and train collisions, or other accidental causes MFWP 1994). Orphaned black bear cubs are placed in the MFWP Animal Shelter located in Helena, cared for the first year and copiously fed, and provided with denning boxes at the shelter in which bears hibernate alone or together as a litter. In past years, orphaned cubs were found permanent homes in zoological facilities, but with time the ability to place young black bear in zoos became and currently is extremely limited.

It was observed in the spring that when cubs first emerged from the denning boxes at the animal shelter they tended to be more wary of people and human activity (V. Yannone, pers. comm. 1988). This quiescent period when cubs were less dependent on humans was used in timing to reintroduce them back into native habitat. Bear dens were excavated using shovel and pick on moderately steep, northeast facing slopes in closed coniferous timber. One den was dug in the South Fork Teton and one in the West Fork Teton River drainages. Both dens were styled in similar fashion to a RMF grizzly bear den because of longer stability and reuse over time.

Reintroductions were conducted by removing orphaned cubs from the shelter denning boxes while still lethargic in January or February of each year, and transporting single bears or if siblings were together the entire litter, and placing them in the dens located in mountainous environments. Every effort was made to maintain cubs in good condition at the animal shelter and allow each bear to gain as much weight as possible prior to the denning period.

Cubs were immobilized, measured, weighed and marked, and a radio transmitter attached to one cub of each litter as described in methods. Immobilized cubs were transported wrapped up in insulating blankets on a toboggan sled pulled by a snowmachine to the den site. Each cub was placed in the den in a partially tranquilized condition, and the den entrance was covered with logs and packed with snow. Litters and single cubs were monitored regularly during the field season months and radio-located on the average of twice a month. Reintroduction success for orphan black bears was defined as an individual surviving one year following den release, without causing any bear-human conflicts.

Between 1989 and 1994, a total of sixteen orphaned black bear cubs were placed in dens in the RMF BMA (Table 12). Eleven cubs were females and five were males. Twelve cubs were yearlings at the time of release (recently turning 1-year olds) and four were 2-year old bears (having been held in captivity for 1.5 years). Average cub weight was 44 kg, ranging 18 to 82 kg, with nine cubs equal

Table 12. Orphaned black bear cub reintroductions between 1989 and 1994 in the Rocky Mountain Front BMA.

Denning Date	Bear No.	Sex	Age	Fat Level	Conflict	Successful	Fate
3/6/89	60	F	1yr	2	No	No	Hunter mortality in fall 1989
1/16/90	142	F	1 yr	2	No	Yes	Alive; unknown after 1991
1/16/90	143	F	1 yr	3	No	Yes	Alive; unknown after 1991
1/17/91	145	M	1 yr	3	No	Yes	Alive; unknown after 1992
1/17/91	146	M	1 yr	3	No	No	Died in spring of 1991 in poor condition
1/18/91	147	F	1 yr	3	No	No	Died in spring of 1991; preyed on by larger black bear
1/24/91	151	F	1 yr	3	Yes	No	Hunter mortality in fall 1992
1/24/92	152	M	1 yr	2	No	Yes	Alive; unknown after 1994
1/24/92	153	F	2 yrs	4	Yes	No	Management removal in summer 1992 on Blackfeet Tribal Lands
2/26/93	159	F	2 yrs	4	Yes	No	Hunter mortality in summer 1993 near Browning, Blackfeet Tribal Lands
2/26/93	160	F	2 yrs	3	No	No	Hunter mortality in fall 1993, Clearwater Ri
2/26/93	161	M	2 yrs	3	No	No	Died in spring of 1994, natural mortality, in poor condition
2/3/94	163	F	1 yr	4	No	Yes	Alive in 1995
2/3/94	164	F	1 yr	4	No	Yes	Alive in 1995
2/3/94	165	M	1 yr	4	No	No	Hunter mortality in fall 1994
2/3/94	166	F	1 yr	3	No	Yes	Alive in 1995

to or greater than 45 kg. Fat level index ratings (1 to 5 scale, with 5 extremely fat) ranged from 2 to 4.5, with an average index of 3.2. The average number of cubs placed in dens per year was 2.7 cubs, although the number increased with experience from one cub in 1989 to four cubs in 1994.

Based on six years of reintroductions, 44% (n=7 bears) were considered to be successful orphan black bear denning releases, while 56% (n=9) died in the first year following placement (Figure 23). Of nine bear mortalities, five were legal hunter kills during the fall season following den placement, three were natural mortalities, and one management removal. Three bears caused bear-human conflicts (residence type conflicts), two of which were 2-yr olds, and one a yearling. All four of the 2-year old bears died, and were either hunter kills or removed. Two bears appeared to have died of malnutrition, and one bear was preyed on by another larger black bear.

Five of the surviving yearling bears were females and two were males. Bears that survived tended to use remote areas away from roads in the upper tributaries of the Teton River and North Fork Sun

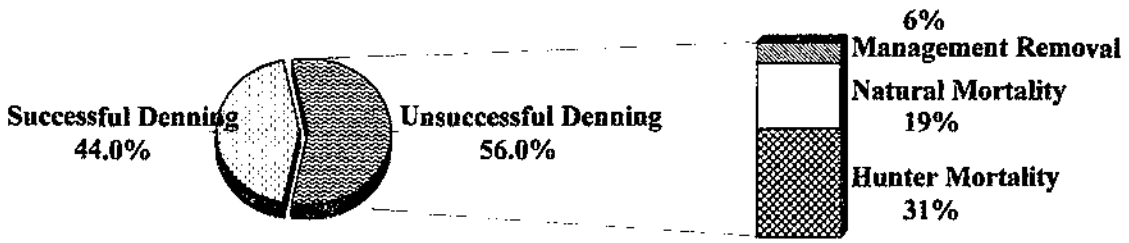


Figure 23. Results of orphan black bear cub reintroductions, Rocky Mountain Front BMA.

River drainages. Bears that were observed or monitored frequently near roads were more vulnerable to hunting mortality in the fall. There was no obvious correlation between fat level and survival. There was no evidence that cubs exited the den in the winter following placement, and most emerged sometime between mid-April and mid-May. Once emerging from dens, eight cubs were known to spend 2 to 3 weeks at the den site, moving in and out of dens, and grazing on much of the green vegetation growing around the den site.

Under natural conditions, subadult black bears typically experience high mortality rates compared to cub and adult age classes. Thier (1990) reported the mortality rate of subadults to be 37% in northwestern Montana. Survival rates of reintroduced subadult bears is less than reported for most research literature, although behavior modification does occur at the animal shelter with combined food conditioning and habituation towards humans. Malnutrition was commonly observed in orphaned bears following den emergence, and likely contributed to mortality along with social pressures exerted by adult bears, as is reported with subadults in the wild (Jonkel and Cowan 1971). It appeared that late spring and summer seasons were difficult for reintroduced bears to locate nutritious foods. If they survived into the fall period and were located away from roads, chances of surviving were greater.

Based on a limited amount of information, the method of releasing orphaned black bear cubs directly from captivity into wild habitats, either in the spring or fall, appears to be less effective than denning placement. Of five such releases with known outcomes (two fall and three spring releases), three bears caused conflicts and were removed, and two were hunting mortalities (S. McMorran, pers. comm. 1994). Reintroduction by denning placement is a more time and personnel demanding

procedure than field releases, but from limited results, appears to provide habituated young black bears time and space to become more wary of humans and begin foraging on their own. This technique could be used for the reintroduction of orphaned grizzly cubs, depending on nuisance history of the family group and how the cubs were cared for in captivity.

Habitat Management

Grizzly Bear Habitat Conservation

The conservation of grizzly bear habitat in the Rocky Mountain Front region of the NCDE involved frequent cooperation and coordination with federal and state agencies, conservation groups, local businesses, and many local concerned citizens during the four year report period. The amount of time, evaluations, and expertise incorporated into the management and preservation of grizzly habitat was difficult to assess for this report because of the number of people and parties involved.

At a program level, a total of 60 interagency meetings were participated in, regarding topics on grizzly bear habitat conservation issues. Fifty five habitat assessement and reconnaissance trips were made in important seasonal areas to evaluate grizzly habitat, land use activities, and bear habitat use. Another 35 mandays were employed in providing coordination and assistance towards grizzly habitat improvement projects, travel and access plans, and continued work efforts towards developing a cumulative effects analysis model for the NCDE east of the Divide.

Within the last decade there have been positive conservation measures accomplished towards securing critical seasonal grizzly bear and wildlife habitat on the RMF foothill and plains interface between private and public lands. This transition zone has the greatest potential for permanent loss of important constituent elements neccessary for maintenance of a viable grizzly population. Within recent years, and during the report period, there have been land aquisitions, consevation easements, and beneficial land management strategies and practices take place along the Front through cooperative work relationships between private landowners, and wildlife conservation groups and agencies.

Three existing MFWP State Wildlife Management Areas located along the Front; the Blackleaf, Ear Mountain, and Sun River WMA's provide a total of 14,344 hectares (35,444 acres) of diverse yearlong habitat extensively used by gizzlies, especially during the spring and falls months. As determined from monitoring efforts, the Blackleaf and Ear Mountain WMA's are important ecocenters with considerable grizzly bear home range overlap occurring in these areas (Aune and Kasworm 1989). Management plans for the Blackleaf and SunRiver WMA's have extended annual spring closures beyond May 15, to June 30 in portions of the areas, to provide secure seasonal areas for bears.

The Nature Conservancy's Pine Butte Swamp Preserve located in the Teton River watershed provides one of the largest expanses of intact prairie and wetlands habitat (7689 hectares), and has

one of the highest seasonal grizzly bears densities on the RMF. In coordination with the MFWP, the Nature Conservancy designed and implemented a travel-access plan for Pine Butte Preserve in 1991 to provide large areas of undisturbed grizzly habitat in response to concerns regarding bear displacement by human activities on the perserve. Based on remote camera photograph "captures", field observations and bear sign within these seasonal area closures, grizzly bear use increased over the four years as a result of access management, including the presence of known grizzly mating pairs and breeding activity.

The MFWP provided technical assistance to The Nature Conservancy, Vital Ground, and private conservationists, which was instrumental in land aquisitions and easements on the RMF to further preserve and protect grizzly bear habitat. These areas include the Toy Property along the Teton River, Peebles additions, Elk Creek inholding properties, including discussions and assistance towards realized and potential conservation easements on private ranchlands. The Theodore Roosevelt Memorial Ranch (TRMR) located west of Dupuyer and owned by The Boone and Crocket Club has implemented range management practices that protect important riparian and upland vegetation communities seasonally important to grizzly bears and other wildlife species. In addition, the TRMR has provided an ideal field forum regarding how agriculture practices and grizzly populations can coexist, despite misconceptions that the grizzly is a wilderness species, where bears and people must be kept apart.

Considering the current grizzly bear population of the NCDE in relation to a limited land base, the most crucial element in long term grizzly bear conservation is the securing of adequate effective bear habitat. The constituent elements of food, cover, denning habitat, isolation and space are important in defining effective grizzly habitat (Craighead et al. 1982). Many critical spring and fall seasonal habitat components occur on lower elevation prairie/riparian and foothill environments, contained within large, intact privately-owned ranchlands along the RMF. Research results have shown that adult female grizzly bear home ranges overlap extensively in these frontland areas, which are highly diverse in vegetation types and contain an abundance of natural plant and animal foods (Aune et al. 1984).

Frontlands in both private and federal ownership have the greatest potential for habitat loss, degradation, and increased negative impacts from land use activities due to ease of access. To a large degree, private ownership of large tracts of remote lands have done more to protect the security and integrity of these areas for grizzly bears than any one conservation measure. Traditional land uses, such as the working cattle ranch, and the support of local people must be an integral part of habitat conservation efforts in the furture.

Habitat Improvement

The Lewis and Clark National Forest (Rocky Mountain District) implemented a 5-year grizzly bear habitat improvement project on RMF federal lands (USFS 1989), and earlier results were described by Madel (1991). Bear-Tree Challenge was designed by the USFS as a cost-share program using

federal and timber industry funding to conduct habitat improvements. Additional field reconnaissance was conducted in 1991 and 1992 to identify potential land areas for habitat improvements. Between 1991 and 1994, approximately 12 ha of montane forest located in three areas of the Beaver Creek drainage were treated by partial timber canopy removal in small patch units ranging in size from .2 to 1.2 ha. Units were broadcast burned to remove logging debris and encourage plant sprouting.

The purpose of the treatments were to improve buffaloberry (*Sheperdia canadensis*) shrubfields and provide undisturbed bear foraging areas by permanent closures of existing access roads. Preliminary results of the projects appear positive in providing small open shrubfields interspersed by a mosaic of mature timbered stands. By 1994 it appeared that in several of the harvested units that re-sprouting of buffaloberry shrubs was being negatively impacted by severe grazing of domestic cattle in their summer livestock allotments. Vegetative response to silvicultural treatments and bear use of the sites were being monitored by the USFS but were not available.

In addition to silvicultural harvest treatements, the USFS also completed a small 4 ha prescribed burn located in the North Fork Teton River drainage, and the planting of whitebark pine seedling trees (*Pinus albicaulus)* in the Elk Creek drainage. Vegetation response and habitat results for these projects were not available.

Habitat Monitoring

Interagency workgroup participation progressed toward finalizing a draft cumulative effects analysis process, developed for the RMF, that will quantitatively and qualitatively assess the cumulative effects of human activity on grizzly bear habitat and use. The cumulative effects computer model, first developed for westside habitats (USFS 1995) is currently being integrated with RMF grizzly bear research data to be validated based on actual habitat use and selection by seasons, instead of theoretical assumptions. Land uses and human activity overlays are being developed by the USFS in coordination with MFWP to be used in the CEM process for describing habitat effectiveness. It is expected the CEM will be completed for the NCDE East in 1996.

A home range evaluation was completed in cooperation with the Blackfeet Fish and Wildlife Department, and the LCNF, to assess the size of adult female grizzly home range areas and apply these results to developing BMU subunits. Work progressed towards delineating BMU subunits for use in the cumulative effects analysis process.

As a result of ongoing cooperative efforts between agencies responsible for grizzly bear recovery, an initial draft Conservation Strategy for the Grizzly Bear, NCDE, was close to completion under direction of the Interagency Grizzly Bear Committee. The conservation strategy document will provide direction and authority to agencies for the conservation and management of the grizzly population and habitats, upon delisting grizzly bears as "threatened" from the Endangered Species List.

MANAGEMENT RECOMMENDATIONS

The results summarized and discussed in this report should assist managers towards evaluating the need and effectiveness of grizzly bear management programs in areas where grizzlies come into frequent contact with people, where the potential for conflicts between bears and humans are great, or bears cohabit lands of mixed ownership and local social attitudes are of a primary concern towards long term grizzly conservation efforts. Management recommendations developed from the results of nine years of intensive field applications should make the MFWP's grizzly bear management program more effective in the future.

A. Grizzly Bear-Human Conflict Management

1. Grizzly Bear Management Plans

Management plans should be developed for all regional areas around the ecosystem and tailored specifically to known or expected grizzly habitat use patterns, traditional human land uses and occupancy levels, and the types of conflicts that occur between people and bears. Management programs by areas should reflect the differences between grizzly subpopulations as well as the people that are resident and are asked to cohabit a shared environment with bears. As part of such programs, the delineation of Bear Management Zones onto nonfederal land areas should assist in prioritizing and allocating program objectives in key seasonal habitats.

Where similarities exist between areas, such as traditional agricultural or timber harvest/recreational land uses, it is recommended that an established bear management program be expanded into adjacent areas that have no implemented plan. The Lincoln/Ovando/Clearwater region located on the southern end of the NCDE is one such area that has been experiencing steadily increasing bear-people conflicts, primarily with livestock depredations, and bears near homes on private lands which are often related to livestock carrion. It would be cost effective, and conflicts more quickly resolved by expanding program objectives, methods, use of manpower and equipment across regional boundaries than to develop and implement a new bear management plans. The Seeley Lake/Clearwater Divide is also an area within the ecosystem in which no plan exists, yet is similar to the west-side Swan Valley region.

Crucial to long-term grizzly bear conservation efforts in a local area is that of informing people that live and work in bear habitat. Education methods should involve active participation with residents and landowners, working cooperatively with people and communities on ways to prevent conflicts with bears, as well as developing an understanding in communities regarding grizzly bear ecology and why bears may be observed near homes certain times of the year. Developing awareness and even appreciation for grizzly bears takes time. Education efforts should be prioritized and planned due to limited time and resources to reach out and inform those people or communities most affected by potential conflicts with bears.

2. Conflict Prevention

From a local resident's point of view when dealing with grizzly bears in their backyard, talk is cheap. Several field methods are discussed in this report that have proven to prevent grizzly bear-human conflicts or significantly reduce the potential for recurrence. Working directly with a rancher, beekeeper, or homeowner that has experienced conflicts with bears by implementing prevention measures that are effective can go a long way towards building acceptance of grizzlies, while shifting away from the idea that bears must be trapped and removed every time a problem arises or bears are observed.

Methods designed to remove or make food attractants unavailable to bears have certainly had more effect on reducing grizzly bear-human conflicts than any other management strategies implemented on the Rocky Mountain Front. The redistribution of livestock carrion early in the spring away from ranch buildings and residential areas should be continued, as well as expanding such a program into new areas where conflicts are known to be related to bears feeding in boneyards. Informing ranch operations about the proper disposal of livestock carrion should be expanded into other agricultural areas that grizzlies occupy such as the Blackfoot-Clearwater Rivers area. From our experience, where grizzly bears naturally feed on livestock carcasses near human dwellings and activity, bears will become habituated to people over time, increasing the potential for conflicts.

In recent years, bear-human conflicts related to unnatural/anthropogenic foods have increased, especially during years like 1991 where important fruit crops such as buffaloberry and chokecherry (*Prunus virginianus*) were sparse. Garbage disposal on private lands, and food storage on the National Forest are key factors in reducing opportunities that bears have to access foods. The deleterious effects of food conditioned behavior in individual bears are difficult to manage, often leading to the compounding problems of bear-people encounters and property damage. Most food-conditioned bears eventually end up being removed from the population. Concerted interagency efforts should continue to focus on making food source attractants unavailable to bears throughout the NCDE.

The special food storage order implemented by the US Forest Service Region One in the NCDE is a positive step forward in that direction while still being sensitive to recreational users in the backcountry. It is obvious that enforcement of this food order as well as well as the ability to prosecute violators based upon the language of the order is weak, and needs to be strengthened if food-related bear conflicts are expected to decline.

Additional strategies and funding need to be developed for private RMF lands in dealing with an increasing trend by landowners to use the services of waste management companies to pickup and haul garbage to refuse sites located outside of the ecosystem. Bear-proof dumpters or garbage containers should be provided to landowners living in occupied grizzly habitat through creative cost-share arrangements. Efforts to develop county-level ordinances on the proper storage of food attractants in occupied grizzly habitat, including intentional feeding of wildlife have been slow in the conservative county governments along the RMF. It is important the cooperative work continue

towards developing county zoning laws that deal with food attractant issues as pressure increases for home construction in existing and potentially new subdivisions on the Front.

In situations where food attractants cannot be removed, techniques that deter or repel bears from accessing such sites should be first used, rather than repetitiously capturing or destroying individual bears. Permanent and temporary electric fences, propane scareguns, livestock guard dogs, and aversive conditioning methods as described in this report can be highly effective in reducing bear-people conflicts depending on the type of situation and attractants involved. Over time, the use of preventative measures around real or potential attractants are more cost-effective by reducing agency manpower and expenses associated with repeated investigations and control actions.

Apiaries, small-livestock bedding grounds, and other annually available attractants damaged by bears in occupied grizzly habitat should be protected with permanent electric fence systems. Transient or short-term food attractants, including backcountry camps can be effectively protected using temporary electric fences of adequate design and voltage as recommended under results (pp. 11-15).

The diversity and technical aspects of noise-generated and chemical bear deterrents and repellents are more readily being introduced, but within the time frame of this report are not discussed. The future looks optimistic for technically advanced methods of deterring bears from specific sites that can be remotely controlled, such as the electronic "critter gitter" and red-pepper spray delivery systems. As is the case for many wildlife management programs, manpower and funding is limited and overtaxed, and proficient methods that can be remotely delivered to already wary individual bears would be more effective.

The use of aversive conditioning methods should be evaluated on a case-by-case basis, carefully weighing the type of conflict and bear behavior exhibited, time limitations, human safety, and expected results. Aversive conditioning should be used as an additional management technique to prevent the removal of certain bears from the ecosystem. In some cases, grizzly bears may be conditioned to avoid people and specific conflict sites. It is evident that attempts to modify undesirable bear behavior is dependent upon a variety of factors, and in particular whether a bear receives and continues to access food attractants.

3. Control Actions

The decision to conduct control actions and attempt to capture nuisance bears should be assessed in relation to the cause of conflict, the location of the incident by zone or situation boundaries, and if determined, the type of conflict behavior exhibited by bears at the site. Often in the case of grizzly conflicts, social or political pressure tend to impel the need for capture efforts, while simple preventative measures instituted at the site would resolve the problem.

The capture and relocation of nuisance bears should be viewed as a temporary solution to a specific conflict. Results have shown that long distance grizzly bear relocations are not a viable, long term means to control nuisance bears, and that the NCDE is not geographically large enough to preclude

bears from returning to original capture sites or to keep a bear from causing similar problems elsewhere in the ecosystem. It is important to recognize the increased mortality risks associated with each grizzly bear relocated, and evaluate the need for long distance translocations versus shorter moves within a portion of a bear's estimated home range area.

Preventative captures can be used successfully to lessen the likelihood of potential conflicts, especially in the context of bears using subdevelopment areas during years of natural food shortages. Again, the hazards of relocating bears to unfamiliar areas should be carefully considered. From our experience, first time captures may also function as a form of aversive conditioning for individual bears, causing strong avoidance behavior to be exhibited following release. It is recommended that food conditioned grizzly bears be given special consideration on whether to relocate or remove them due to the danger they represent to people in recreational areas. Although livestock depredating bears tend to be controversial, relocation success tend to be greater with these grizzlies, because of exhibited wariness towards humans.

B. Grizzly Bear Habitat and Population Management

Interagency cooperative work and funding should continue towards developing a NCDE-East grizzly bear cumulative effects model (CEM) designed to analyze cumulative effects of all land use impacts and activities at the BMU subunit scale, incorporating federal, state, and private lands within occupied grizzly habitat. This requires that habitat coefficient maps be created using a raster-based Geographic Information System (GIS) and satellite imagery scenes, integrated with research telemetry data. Habitat modeling should identify seasonally important coefficient values across the landscape as well as assess the impacts various land uses have on those components.

The CEM process along with grizzly bear/motorized access management plans should be regularly used to assess the current existing situation on the RMF, and whether or not adequate regulatory mechanisms are in place to protect and improve grizzly bear habitat and security. Proposed land use activities on federal and state lands within the recovery area should be evaluated for potential impacts to the grizzly bear population at the BMU subunit level.

It is recommended that a Grizzly Bear Conservation Management Strategy Plan for the NCDE be completed through interagency participation and cooperation, and that it be distributed for public review. This plan is crucial and mandatory to move towards the process of ESA delisting for the NCDE grizzly bear population, once all recovery parameters are met.

Habitat preservation is key to the long term survival of the NCDE grizzly bear. Efforts to secure significant tracts of high quality habitat on private lands should continued to be pursued by working together with conservation groups, landowners, and agencies, utilizing tools such as conservation easements, land trades or acquisitions. A plan should be developed for the RMF in coordination with the CEM process to prioritize seasonally important areas for habitat conservation ventures.

Population parameters, including observations of adult female grizzly bears with young, distribution of all grizzly observations, and reproductive characteristics should continue to be collected in a repeatable method each year. Observation coordinators for each regional area need to collate and review observations and present data summaries in relation to recovery parameters. Additionally, new techniques such as DNA fingerprinting based on microsatellite analysis and applied to mark-recapture samples (bear captures/hair samples), may provide more accurate population data, including documentation of surviving reproductive females, and paternity lines.

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APPENDIX A

Definitions of Key Terms

Aversive Conditioning: Modifying behavior by pairing undesirable behavior with negative stimulus. Aversive conditioning should modify undesirable bear behavior through the use of repellents or deterrents.

Bear-Human Conflict: Any conflict incident between bears and humans where bears approached people or occupied dwellings, damaged property, preyed on domestic livestock, damaged apiaries, foraged in crop or orchard plantings, and charged or injured people. Conflicts typically are confrontations between people or property and bears in which human safety is jeopardized or property loss occurs.

Bear Injury: Incidents in which a bear(s) is injured by people as a result of a conflict, not resulting in mortality.

Bear Management Area (BMA): Broad geographical land units of the NCDE divided into ecologically similar areas for the purpose of general grizzly bear management programs and applications, including the state grizzly management plans.

Bear Management Unit (BMU): Geographical land units that were delineated based on yearlong grizzly bear habitat requirements, containing all necessary constituent habitat elements for the survival of one or more adult female bears. There were 23 BMUs delineated in the NCDE to assist in monitoring grizzly population characteristics and to evaluate the cumulative effects of human activities and land use impacts on bear habitat.

Bear Management Zone (BMZ): Geographical land areas delineated on the RMF based on grizzly bear seasonal habitat use patterns in relation to human occupancy levels/ownership and social tolerance. Each of four zones contain distinct habitat conditions and conflict management prescriptions that range from allocations favoring grizzly bear use to those that discourage bear presence.

Beehive Damage: Incidents in which bears damage domestic apiaries by scatterring beehives, depredating on honey, bees, and larvae, or destroying hive combs.

Behavior: The actions or reactions of bears in response to external and internal stimuli. Behavior patterns related to bear-human conflicts are categorized in Table 6.

Campsite: Incidents in which bears entered occupied backcountry camps or developed campgrounds.

Capture: Incidents in which bears are physically captured during a control action, which may involve the offending bears or at times be an incidental bear capture. In all nuisance bear captures, bears are permanently marked and translocated from the conflict site.

Control Action: A management action taken at a bear-human conflict incident which involves specific capture methods with the objective being to control nuisance bears. Control actions include the setting of culvert traps and steel-cable snares, helicopter and free-range immobilizations, and direct management removals.

Crop Foraging/Damage: Incidents in which bears foraged in and caused damage to grainfields, gardens, or fruit orchards.

Deterrents: Application methods that prevent undesirable behaviors by turning bears away from from a site before a conflict occurs, such as the use of electric fences or noise-generated scareguns at apiaries or sheep bedding grounds. Deterrents are typically not manually activated by people.

Encounter: Incidents in which bears approached, charged, or behaved aggressively towards people while using backcountry trails, in campsites, or near occupied dwellings.

Human-Caused Bear Mortality: Any bear mortalities known to have been a result of direct or indirect human induced causes, including bears being shot by firearms or other projectiles, vehicle or train collisions, poisenings, accidental handling deaths, or bears removed from the ecosystem for management reasons and sent to a zoo or humanely destroyed.

Human Injury: Incidents in which people were injured by bears during an encounter.

Illegal Mortality: Incidents in which investigation determined that grizzly bears were killed illegally, not including legal hunting mortality or in the case where bears were killed in defense of human life.

Livestock Depredation: Incidents in which bears killed or injured domestic cattle, sheep, pigs, poultry, or other animals. Attempted depredations by bears without livestock injuries are rare and also included in this category.

Nuisance Bear: Any bear that is determined by capture or investigative evidence to be involved in a bear-human conflict incident.

Preventative Measures: Management techniques applied in the field that reduce the potential for bear-human conflicts. These are noncontrol action methods that range from investigations along with education to the construction of large permanent electric fences that deter bear access.

Property Damage: Incidents in which bears damaged personal property including camping equipment, vehicles, buildings and attachments, birdfeeders, grills, or yard implements.

Relocation: Incidents in which bears are captured at conflict sites or as a preventative measure and translocated away from the capture site by being transported by vehicle or helicopter to another predetermined remote location away from human activity.

Repellents: Application methods that modify undesirable behavior by delivery of painful stimuli which should immediately turn a bear away during a conflict or close approach. Repellent such as plastic bullets and other projectiles shot from firearms, or capsaicin sprays are typically monitored or manually activated by people.

Residential: Incidents in which bears were in near proximity or frequenting areas around occupied homes, cabins, or lodges, including adjacent in-use outbuildings such as barns or storage sheds.

Self Defense: Incidents in which investigation determines that grizzly bears were shot and killed in defense of human life.

Unnatural Foods: All anthropogenic human foods and liquids, garbage, livestock feeds, bird seed and pet food that are accessible or made available to bears in occupied bear habitat.

APPENDIX B

Montana Department of Fish, Wildlife & Parks
Rocky Mountain Front Grizzly Bear Management Program

I. INTRODUCTION

Definition
A long- term regional wildlife program representing a localized application of measures necessary for the conservation of the grizzly bear (*Ursus arctos h.*), within an area where frequent conflicts between bear and man occur.

Development
Developed from grizzly bear research information collected during ten years of intensive study (1977 - 1986) in the Rocky Mountain Front area (RMF). Research data were collated with regional social factors (land ownership, occupancy, and uses) to prioritize human-bear conflict areas, and effectively allocate management objectives and activities.

Overall Program Goal
To secure and maintain a recovered grizzly bear population in the RMF area while minimizing conflict between bears and people.

Specific Management Goals
1. To maintain a viable, self-sustaining grizzly subpopulation in the RMF area.

2. To minimize the rate of, and potential for human-bear conflicts: especially on private lands along the front where competition for resources is most intense between people and bears.

3. Monitor and maintain habitat values in conditions suitable to support a viable grizzly population.

As part of the Northern Continental Divide Grizzly Bear Ecosystem, the RMF management program supports the goals of the grizzly bear recovery plan (USFWS 1982), and meets to objectives outlined in the programmatic environmental impact statement for northwestern Montana (MDFWP 1986).

II. PROGRAM MANAGEMENT STRATEGIES

1. **Human-Bear Conflict Management**
   - Information and education
   - Preventative actions
   - Controls actions
   - Management action allocation

2. **Population Management**
   - Grizzly population characteristics
   - Population distribution
   - Population trends
   - Mortality
   - Hunting

3. **Habitat Management**
   - Monitor habitat conditions
   - Habitat improvements
   - Habitat acquisition and land easements

4. **Program Evaluation**
   - Periodic program review
   - Current research information
   - Program revision
   - Budget analysis

III. STRATEGY DIRECTIVES

Human-Bear Conflict Management

A. Information and Education

Management Objectives and Methods

- Active public relations: inform and cooperatively work with private landowners and local communities on ways to coexist with bears.
- Systematic education program: scheduled group presentation to public and private land users.
- Interagency cooperation in disseminating bear information; U.S. Forest Service (USFS), Bureau of Land Management (BLM).
- Sample and evaluate local public attitudes towards grizzly bears and the RMF Management Program.

B. Preventative Actions

Management Objectives and Methods

- Removal or control of unnatural food sources
  1. Garbage storage and disposal
  2. Reduction of livestock boneyards
  3. Carcass redistribution
  4. Apiaries - electric fencing around beeyards
- Limited access or area closure on public lands
  1. Interagency cooperation: USFS, BLM, MDFWP
  2. Information dissemination
  3. Campsites, trails, other recreational facilities
- Aversive conditioning: use of deterrent or repellent techniques to alter bear behavior
- Enforcement: regulations and patrol

C. Control Actions

Management Objectives and Methods

- Determination of problem bear status.
  1. Interagency Plan for Determining Grizzly Bear Nuisance Status (1986)
  2. Cooperative Interagency effort between MDFWP, U.S. Fish and Wildlife Service (USFWS), Animal and Plant Health Inspection Service (APHIS), and Blackfeet Indian Reservation.
  3. Immediate action response
- Capture of problem bear(s) to resolve conflict.
  1. Stationary: culvert traps and leg-hold snares
  2. Mobile: helicopter immobilization
- Aversive conditioning: use of conditioning agents to control conflict reoccurrence, and alter undesirable bear behavior.
- Relocation to preselected sites.
  1. Interagency plan guidelines
  2. Evaluation of relocations and monitor problem bears
- Removal of problem bear from ecosystem.
  1. Destroy offending bear
  2. Acceptance to zoological garden
  3. Limited-entry grizzly damage hunt

D. Conflict Management Allocation

Management Objectives

1. Delineate and prioritize human-bear conflict areas.
2. Effectively allocate and direct conflict management activities to meet program goals.
3. Quickly respond to, and resolve human-bear conflicts.
4. Reduce the potential for human-bear conflicts while encouraging grizzly bear use of seasonal or yearlong habitat essential to population recovery.

Grizzly Bear Management Zones

Four Bear Management Zones have been developed, each with distinct habitat conditions and conflict management prescriptions that range from zone allocations favoring grizzly bear use to those that discourage bear presence.

Management Zone A (Green Zone)
Essential year-long grizzly bear habitat

Management Zone B (Yellow Zone)
Essential seasonal grizzly bear habitat

Management Zone C (Red Zone)
High levels of human use within zones A and B

Management Zone D (White Zone)
Areas not essential for grizzly bear recovery

MDFWP Bear Management Zones are similar in scope to the Interagency Grizzly Bear Management Situations (IGBC Guidelines, 1986), but major emphasis and application is directed to private lands where management opportunities are limited. On federal lands, zone boundaries coincide with Management Situations and support stratified objectives and management direction.

Management Zone A

Description / Management Direction

-The area contains year-long grizzly bear habitat essential to maintaining a recovered population.
-The area encompasses federal, state, and private lands with low levels of human occupancy or activity.
- Management priority will be to minimize human-bear conflicts with rural landowners and public land users.

Conflict Management

-Active public relations with rural landowners
-Cooperative interagency information programs
-Removal of unnatural food sources, limiting access and enforcement.
-Control actions taken only in the case of livestock depredation or human-bear conflicts (aggressive or unnatural behavior displayed).
-Aversive conditioning; carcass redistribution.

Management Zone B

Description / Management Direction
- -The area contains seasonal grizzly bear habitat essential to maintaining a recovered population.
- -The area encompasses private lands with moderate levels of human occupancy and activity.
- -Management direction will favor seasonal grizzly bear use, but discourage the presence of bears for extensive periods.
- -Management priority will be to minimize human-bear conflicts with landowners.

Conflict Management
- -Active public relations with landowners.
- -Cooperatively work with landowners to remove or limit access to unnatural food sources and attractants.
- -All bear sightings will be investigated upon request.
- -Control actions taken in the case of human-bear conflicts, or as preventative measures to correct a highly probable conflict from occurring.
- -Livestock boneyard program/carcass redistribution; grizzly damage hunt; aversive conditioning.

Management Zone C

Description / Management Direction
- -The area contains high levels of human occupancy, use, or activity within management zones A and B resulting in conditions which make grizzly bear presence untenable.
- -Includes developed campgrounds, resort, summer homes, and subdivisions.
- -Management direction will be to actively discourage grizzly bear presence and factors contributing to their presence.
- -Management priority will be to prevent human-bear conflicts.

Conflict Management
- -Cooperative interagency information program
- -Intensive efforts to assure adequate removal of bear attractants.
- -An immediate response to all bear sightings reported.
- -Control actions taken in the case of any bear frequenting an area.
- -Preventative actions; capture of problem bears; relocation or removal.

Management Zone D

Description / Management Direction
- -The area is not essential for grizzly bear recovery or population maintenance.
- -The area encompasses private lands with moderate to high levels of human occupancy.

-Management direction will be to actively discourage the presence of grizzly use or movement in the area.
-Management priority will be to prevent grizzly use or movement in the area.

Conflict Management
-Immediate control actions will be taken in the case of any grizzly bear frequenting an area.
-Highest priority areas are applied within a three mile area surrounding local communities.
-Capture; relocation or removal; aversive conditioning; limited entry grizzly damage hunt.

Population Management

Management Objectives
1. Manage for a recovered grizzly bear population at an average density between 1 bear/15 square miles to 1 bear/30 square miles .
2. Seek to maintain bear population distribution throughout the RMF Management Area.
3. Monitor grizzly population characteristics, mortality, distribution, and long-term trends on an annual basis.

A. Population Characteristics
-Age, sex, reproductive, and survival data will be collected from all grizzly bears handled and monitored for management purposes.
-Reproductive characteristics (female with cubs, litter size, reproductive rate and cycle) will by computed from capture and observation data.
-Population numbers and density will be estimated from information gathered through total observation information gathered from aerial transect surveys and systematic report surveys.

B. Population Distribution
-Grizzly population distribution will be evaluated from information gathered through total observations, human-bear conflict locations, and mortality patterns.
-Seasonal, annual, and long-term changes in the distribution of grizzly bears will be documented, and corrective measures identified and implemented.
-Range expansions or contractions will be documented.

C. Population Trends
-Document and monitor long-term grizzly bear population trends by evaluating a combination of subjective observation data, systematic counts, and population estimates.
-Trend monitoring methods:
   1. Systematic bear observation survey of professional agency personnel, outfitters, landowners, other user groups.
   2. Systematic sampling counts in seasonal concentration areas, including ;
      a. Helicopter survey transects in preselected low elevation riparian shrub field corridors,

during the spring prior to full canopy development.

b. Helicopter surveys in high elevation digging - foraging areas during the summer.

D. Mortality

-Compilation and analysis of grizzly bear mortality information.

-Document annual total mortality, man-caused mortality, and unreported illegal mortality.

-Determine male/female sex harvest ratio, median age of harvest, and distribution patterns of human-caused mortality in the RMF area.

E. Hunting

-Hunting will be used as a management tool to preserve yet regulate the NCDE grizzly bear population. Evidence suggests theat hunting maintains a certain wariness in the grizzly population by removing the most aggressive and bold animals, and through learned behavior in avoiding human confrontation.

-Hunting season and quota recommendations will be based on population characteristics and trend data.

-Limited-entry damage control hunts will be used to selectively remove nuisance grizzly bears determined unsuitable for further relocation.

Habitat Management

Management Objectives

1. Monitor and maintain habitat conditions suitable to support a recovered grizzly population.
2. Identity and conduct habitat improvement projects which would positively increase the grizzly habitat base.
3. Delineate seasonally important areas to grizzly bears for potential habitat acquisition or conservation easements.

A. Habitat Maintenance

-Interagency workgroup participation in developing and updating a Cumulative Effects Analysis Process for the RMF (USFS, BLM, USFWS, MDFWP).

-This process will quantitatively and qualitatively assess the cumulative effects of human activity on grizzly bear habitat and bear use (USFS 1986).

-The CEM process will be used as a management tool for evaluating habitat conditions, monitoring changes in habitat components, and assessing overall habitat effectiveness.

B. Habitat Improvements and Acquisition

-Field reconnaissance will be made within essential seasonal grizzly habitat to identify and delineate potential land areas for habitat improvements, habitat acquisition, and land easements.

-Possible improvement projects including burning decadent or conifer encroached fruit-

producing shrubfields, planting fruit-producing shrubs, protecting important riparian areas from livestock, encouraging aspen (*Populus tremuloides*) regeneration.
-Work closely with private conservation organizations, groups, and agencies to secure critical grizzly habitat for future protection.

Management Program Evaluation

-The RMF Grizzly Bear Management Program will be reviewed annually, and evaluated for its effectiveness in meeting program goals and objectives.
-New research information will be reviewed as it becomes available, and relevant data incorporated into the management program.
-Every five years the management program shall be subject to complete revision based on updated management direction, goals, and social concerns.

APPENDIX

Specific Program Plans

1. Livestock Boneyard Reduction and Carcass Redistribution
A cooperative agreement with private landowners and ranch operations to phase out and control livestock boneyards. Animal carcasses will be removed from sites in Management Zones B and D, and redistributed randomly in isolated low-conflict areas in Zone A, including MDFWP Wildlife Management Areas and Nature Conservancy lands.

2. Grizzly Bear Damage Control Hunts
A limited entry hunt for the purpose of removing grizzly bears, considered as nuisance animals and unsuitable for further relocation, by licensed hunters accompanied by MDFWP personnel. Hunters are notified from a randomly drawn roster as bear damage situations arise.

3. Grizzly Bear Population and Reproductive Characteristics for RMF, 1980 - 1986

Population Density (Marked plus observed)	1 bear / 20.0 mi2 (1 bear / 51.0 km2)
Mean Litter Size Cubs	2.29 cubs
Mean Age First Litter	5.5 years
Litter Frequency	2.1 years

APPENDIX C

MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS

Office Memorandum

Date: 12/7/90

To: Graham Taylor

From: Michael Madel, John McCarthy, Gary Olson

Subject: Region Four 1991 grizzly bear hunting season recommendation.

Provided is the justification and supporting information for the addition of a limited entry spring grizzly bear hunting season within the boundaries of the Region Four Rocky Mountain East Front Bear Management Area.

Species Grizzly Bear, Ursus arctos **Region** Four **Year** 1991

Hunting District Rocky Mountain East Front Bear Management Area

1. Describe proposed season change and give summary of prior history.

1991 Season Proposed: The addition of an early spring grizzly bear season, beginning April 1 and running through the end of the first week of May (5/4/91). A limited entry hunt during the five week season with 50 permits would best provide for a recommended spring harvest level of 3 bears under the existing annual quota system. Furthermore, a spring season subquota of 2 females bears would protect the integrity of the RMEF BMA annual female subquota prior to the end of the year. The fall grizzly bear season would be maintained within the current season regulations with a beginning date of October 1, 1991.

1986 to 1990 Season History: The Northern Continental Divide Grizzly Bear Ecosystem (NCDE) is divided into 3 bear management areas of which the Rocky Mountain East Front Bear Management

Area (RMEF BMA) is one. In 1986, the quota was set at a total of 14 grizzly bears with a subquota of 6 females taken by hunting or other human caused mortalities. The RMEF BMA has its own subquota of 3 females. All three BMA,s are open to hunting October 1 for any grizzly bear license holder, and will continue until 48 hour notice in appropriate BMA if total mortality quota or female subquota are reached, but will close no later than the end of the general big game season.

2. Why is the proposed change necessary? What is the population and habitat objective and how does this change relate? Provide prior years of survey, harvest, or other related information that supports this change.

The objectives of the proposed season change are:

a) Continue to manage for a viable, recovered grizzly bear population through an intensive management program and the use of restricted mortality quotas.

b) To provide predictable hunter opportunity on an annual basis, while concentrating hunter effort in low elevation areas that experience grizzly-human conflicts.

c) To minimize the possibility of female bears being taken in the harvest while increasing the potential for removing problem bears in the male and subadult classes.

d) To maintain consistent hunting pressure on the RMEF grizzly population in order to retain a certain level of behavioral wariness towards people and property.

MDFWP goals for the NCDE are to manage for a recovered grizzly bear population, to maintain distribution in the management area, and to maintain the habitat in a condition suitable to sustain the population at an average density between 1 bear/30 mi sq to 1 bear/15 mi sq (excluding Glacier National Park)(Dood et al. 1986). Additionally, the proposed season would assist in meeting specific objectives established to remove the grizzly bear from its threatened status in the NCDE, which briefly are; to observe 12 adult female grizzly bear with cubs (10 FWC inside GNP) over a running 3 year average, 20 of 23 BMU's occupied by females with young from a 3 year sum of observations, and known mortality outside GNP not to exceed 14 total or 6 females annually on a running 6 year average (USFWS 1990 draft).

The most current population estimates for the ecosystem vary from 440-680 bears (USFWS 1990 draft). Aune and Kasworm (1989) stated that trend data collected from the RMF core area (Deep Creek north to Birch Creek) indicated that a stable or slightly increasing population existed during 1977-87. In addition, these data suggested that the population in the core area may have approached the carrying capacity of the habitat in which the bear is being allowed to exist. Grizzly bear densities varied geographically within the RMEF BMA. The estimated mean density of bears between the Badger-Two Medicine area (north of Birch Cr. drainage) and the core area was similar, but significant difference with the area south of the Sun River where the density was much lower (Aune and Kasworm 1989).

Under the constraints of the NCDE season structure, the annual grizzly bear hunting season over the past five years has become unpredictable in nature. Because of this and season timing, hunter opportunity afield is unpredictable, hunter success has decreased (less than 2%), harvest rates have decreased, and the ratio of females in the harvest has increased (for 1986 to 1990; 38% males to 62% females compared with 1975-1985 of 63% males to 37% females). Season length has varied considerably from a minimum of 6 days in 1987 to 57 days in 1989. Annual harvest rates have declined from a mean 10.8 bears/year (1980-1985) to 2.6 bears/year (1986-1990). There has been expressed dissatisfaction by a significant proportion of bear hunters regarding the uncertainty of the grizzly season during this period. Specifically, the RMEF BMA average harvest rate has been 0.6 bears/year (86-90), with a mean 39 hunters afield/year and a success rate of 1.7 percent (1987-1990 for which data was available).

Although total problem grizzly bear situations (including human foods, carrion related, people-bear encounters, and depredations) have decreased since 1986 in the RMF area, livestock depredations have increased and the Department continues to respond to human-bear conflicts. Nuisance grizzly bears involved in reoccurring conflicts are predominately subadults and yearlings (79 percent). Aune and Kasworm (1989) found that of problem bears captured over a ten year period on the RMF, 81 percent were males with subadults comprising 86 percent. Most problem bear situations occur prior to the beginning of the fall grizzly hunting season, consequently bears captured on a second or third offense and considered poor candidates for the damage hunt must be removed from the population. Intensive control management actions are expensive and time consuming and often oriented to lowland subadult bears that have become habituated to people, food conditioned, or predating on livestock.

An early spring hunting season would tend to concentrate hunting pressure on the male and subadult portion of the population using lower elevation habitat. More visible or less wary bears will have a higher probability of being harvested, and possibly a learned pattern of avoidance strengthened in other individuals. The indirect effects of hunting indicate that bears survive because of genetic selection and learned behavior in avoiding confrontation and withdrawing from human contact (Mysterud 1977, Servheen 1981, Herrero 1985).

Hunting season dates influence the sex ratio of bears in the harvest. Male bears are more vulnerable to harvest as affected by earlier emergence from dens and greater mobility (Nagy et al. 1983). Early fall and late spring seasons result in a higher percentage of females in the harvest (Dood et al. 1986, Troyer 1961). By adjusting season dates to coordinate with adult female grizzly denning chronology, the take of the most important sex-age class can be reduced. In the RMEF BMA, adult female median den emergence dates range from April 4 (with no cubs) to May 1 (with cubs)(Aune and Kasworm 1989). The average time interval between den emergence and movement away from the den was 10.1 days for females, giving a median range of April 14 to May 11. Assuming that hunting pressure is relatively consistent over the season, a closing of the end of the first week of May should adequately protect adult female bears.

The Waterton Bear Management Unit of Alberta is ecologically similar to that of the RMF BMA with its eastern front of prairie and riparian habitat. The Alberta Fish and Wildlife Division operate a spring only grizzly bear season from 5 to 6 weeks under a restricted permit system (Alberta F. & W. Div. 1989). Hunter success over an eight year period in the Waterton unit averaged 6 percent with a 95% hunter participation rate (352 permits/21 bear harvest). During this same period the mean sex ratio of the harvest was 85 percent males to 15 percent females (J. Gunson, pers. communication 1990). As it relates to harvest rates, Miller (1990) stated that under optimal conditions for reproduction, natural mortality, and with males twice as vulnerable as females, maximal sustainable hunting mortality was estimated as 5.7% of the total grizzly bear population. A harvest rate of 3 to 4 percent is a normally sustainable level of annual harvest as documented by several management agencies (LeFranc et al. 1987).

Based on this information, a spring harvest level of three bears in the RMEF BMA would be anticipated. Oriented to the male segment, this harvest would be biologically sound and compatible with an average fall harvest rate of 0.6 bear. Total hunter harvest would then account for 3 to 4 percent of the minimum RMF grizzly bear subpopulation estimated by Dood et al. (1986). Assuming 100% hunter afield participation at 6 percent success rate allows for a total of 50 permits in the spring hunt to meet the 3 bear harvest rate. Although the NCDE fall hunter success rate has been between 2-3 percent (1985-90), spring bear hunting is generally more successful because of vulnerability of bears on low elevation habitat (Troyer 1961). Greater hunter participation can also be expected under a limited entry permit system compared with a general license hunt. A female subquota (2) applied to the spring season, which upon being reached would close in 48 hours/notification, will further assure that the annual RMF subquota (3) is not met prior to the end of the year.

3. Provide pertinent information related to any weather or habitat factors that have relevance to this change.

Due the timing of the proposed spring season, all the MDFWP Wildlife Management Areas located along the RMF (Blackleaf, Ear Mountain, and Sun River WMA'S) will be closed to bear hunting until May 15, and thus will generally provide geographically spaced islands of habitat security. Certain patterns of private land ownership containing spring grizzly bear habitat will preclude any bear hunting. This is particularly relevant in the area south of the Sun River where large tracts of private land are closed to bear hunting. This will likely distribute much of the early spring hunting effort, which occurs before vegetation greenup in the foothills, on low elevation lands north of the Sun River to Birch Creek. A certain amount of hunting effort will occur on lower elevation U.S. Forest lands depending on seasonal weather variations.

4. Briefly describe the contacts you have made with individual landowners or sportsmen, public groups or organizations regarding this proposal and highlight their comments.

The idea of a spring grizzly bear season on the RMF has been discussed with many local landowners

and interested bear hunters over the past three years. In general, there has been overall support for a more reliable spring season even though there may be fewer bears available to hunt at this time of the year. Following is a partial list of landowners, groups, and agencies contacted regarding the proposed season.

Mr. & Mrs. Jack Hayne, Dupuyer Legislative Representative
Mr. John Shuler, Dupuyer
Mr. & Mrs. Mark Taliaferro, Dupuyer
Mr. & Mrs. Bill Jones, Bynum
Mr. Earl Perkins, Bynum
Mr. Chip McGillis, Choteau
Mr. Roy Jacobs, Choteau
Mr. Stan Rasmussen, Choteau
Mr. & Mrs. John Cobb, Augusta Legislative Representative
Mr. Richard Jackson, Outfitter/Guide, East Glacier
Mr. & Mrs. Norm McDonough, Wolf Creek
The Nature Conservancy
Great Bear Foundation
US Forest Service
US Fish & Wildlife Service
US Bureau of Land Mgmt

Most landowner and sportsmen contacts supported the spring season as it is proposed. Agency and private groups listed above supported the concept of a limited entry spring season, but commented that the fall grizzly season would need to be reduced, started at a later date, or eliminated on the RMF in order to have beneficial results from a spring season and to further assure protecting females on an annual basis.

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